

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW
OF THE SCIENCE
AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

YEAR VIII - NUMBER 10
OCTOBER 1917



ROME
PRINTING OFFICE OF THE INSTITUTE
1917

In quoting articles, please mention this BULLETIN.

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The Editor's notes are marked (Ed.).

FIRST PART.
ORIGINAL ARTICLES

Present State of Sheep Breeding in Canada.

by

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Sheep raising is fast becoming one of the most important branches of live stock production in Canadian agriculture. The climate is most conducive to thrift in sheep, and conditions of agriculture obtaining here, though varying in the different provinces, are, in most respects, adaptable to the successful prosecution of some system of sheep farming. In fact, countries of similar area possess so many natural advantages for sheep rearing, which may be carried out in some parts of the country in form of extensive ranching and in others, of intensive small flock farming.

For many years sheep raising in Canada lay dormant. From 1890 to 1910 an actual decrease occurred in sheep population and the average farmer appeared to lose all interest in this industry. Many reasons can be attributed to the assumption of this attitude: 1) extremely low price of wool; 2) serious depredations by dogs and, in the Western provinces, by coyotes, without adequate control of these animals and reimbursement of losses; 3) haphazard marketing methods of both wool and mutton; 4) lack of governmental recognition of the potential importance of the industry; and 5) serious annual depletion of the best breeding stock through culling. Up to 1910 the industry was altogether looked upon as a back issue in Canadian farming. Passing interest alone was taken in it and this of the most cursory type. Then a shortage occurred, so that the industry could not adequately supply domestic needs and with the resulting high prices the necessity of reinvigorating the industry became self apparent.

It is worthy of mention in this respect that during the period of the previous Canada was winning, in many instances, the bulk of the prizes for the long and medium-wooled classes for sheep in American Stock shows, and was demonstrating the native ability for breeding and feeding sheep.

Canadian sheep breeders were always at the fore in International Exhibitions on this continent, much more so than in any other line of live stock production, which caused the impression that this was the most important branch of the live stock industry. This reputation, however, was gained and upheld by about twenty breeders, who did produce and fit a most superior class of sheep, covering all of the most prominent mutton breeds. They were showmen and breeders of high merit; they did not represent the average sheep-raiser. Their sheep were eagerly sought by American buyers and few were retained in the country to improve the Canadian breeds. In fact, unfortunately it might be said that they catered directly to the United States market where their influence and reputation was wide spread; in Canada it was seldom more than local.

Conditions since 1910 have changed. The attitude of the big breeding has changed, along with allied interests and the government. Canada's position as a sheep raising country has been made clear. The awakening came with a recognition of the dearth of superior stock in the country, subsequently emphasised by the war. The federal and provincial governments early took up the problem of replenishing and improving the stocks. Those breeders who formerly had been exporting to the United States observed the necessity of reserving their animals for domestic breeding. More effective dog and wild animal laws were passed, which placed the industry on a safer basis. The federal government initiated a scheme of cooperative selling of sheep products, which gave to the producer a fair return of value in marketing.

A review of this cooperative work with wool will be helpful in showing the advance which has occurred in this respect. It began after the investigation in 1912 and is supported by the federal department of agriculture. Up to this time, medium wool (about a 50 in spinning qualities) had sold by the producer at approximately eight cents per pound. The reasons for this condition are: 1) improper preparation of the fleece to suit the market demands; 2) purchase by dealers on a flat basis—same price for dirty as for clean; for fine as for coarse; 3) a tariff on cloth and actually none on wool or tops. Under the old system of marketing, the wool passed through many hands before it ultimately reached the consumer. Under the present system the producer sells directly to the mill. Besides, the wool is classified, which places a premium upon efficient production and preparation. This method of selling has increased rapidly. In 1914, following an educational campaign in 1913 to prepare the way 206 129 pounds of wool were graded and sold by societies organized in four provinces, namely Quebec, Ontario, Manitoba and Alberta. In 1915 the number of organizations formed for this purpose was increased to nineteen. Approximately 420 000 pounds of wool were classified and offered for cooperative sale. In 1916 this amount had reached the total of 1 721 598 pounds with a value of \$ 579 678.69 and every province was represented. This amount in 1917 will probably surpass 4 000 000 pounds. Small collecting depots have been established throughout the country and a central warehouse, controlled and operated by the Federal Govern-

ent, has been located at Toronto, the centre of textile manufactures for Canada. Here wool is shipped, classified, stored and sold by auction. Financial facilities, through regular banking channels, have been accorded to the producers, whereby they are enabled to obtain upon shipment 75 per cent. monetary advance upon a fair appraisal by government agents. It is expected that the entire Canadian wool clip will ultimately be disposed in this fashion.

These cooperative associations are composed solely of sheep-raisers who are responsible for and control wholly, their own business affairs. A laried manager or secretary is appointed from among themselves. The federal government, however, performs or supervises the classification of the wool and other sheep products and provides storage and selling facilities at cost price. No compulsion rests on the part of the government except in so far as the grading of the product is concerned. It is the purpose in this respect to create a standardized Canadian article especially for export but for interprovincial trade as well.

Sale of sheep on the hoof for the shambles and for breeding purposes also being carried out in similar fashion by these associations. In this regard, the federal government encourages the conservation of breeding males. Should a society find it incumbent, for reasons of a surplus in a district or the necessity of liquidation, to dispose of females suitable for retention as breeders, the government provides facilities for retaining these animals until a suitable purchaser is found in another section of the country. Besides, the federal department of agriculture loans sires to selections of breeders in localities where the farmers are financially unable to obtain purebred rams of first-class type. The government maintains a supervision of the breed which shall be used by any association and persistence to the original selection is insisted upon. This tends to create uniformity of type in a district and represents an advance toward the community system of breeding.

The spirit of cooperative effort has extended, since inception, to other phases pertaining to sheep management and production. The purchase of necessary supplies such as feeds and dipping, or shearing apparatus, represents another feature. Community dipping and shearing are so making rapid progress. Sheep-raisers are finding it much more probable and effective to work together and pool their activities rather than continue as formerly under the system of individualism. However, it must be pointed out that all development tending in this respect comes solely from the farmers themselves, and governmental action depends entirely upon their advice and recommendation and is responsible to their action.

The increase in the number of sheep in Canada since the rejuvenation period began in 1910, has not been great. This is due to the outbreak of the great war and the demands created by it for men and sheep products. There are now over 2 250 000 sheep in the country, which represents an increase of about 200 000 since 1914. Upon a return to normal conditions it is confidently predicted that rapid progress will take place. This popu-

lation is scattered fairly uniformly over all the provinces except Ontario where about 40 per cent. of the total are raised. Under ordinary conditions, Canada did produce about 75 per cent. of its mutton consumed, the remainder coming mostly from Australia and New Zealand. A small reciprocal trade occurs with the United States, which generally forms a more or less complete balance and depends upon the variations of border markets. For instance, one week the Toronto market may be a degree higher, for purely local reasons, than the Buffalo, and consequently shipments will come from Buffalo, a short, four-hours' journey, or the reverse condition may exist. Wool production scarcely more than equals 50 per cent. of the consumption. However, in this respect some grades, the coarse and lustre, are produced here which are not to any degree consumed and not sufficient of the fine classes are raised. The reason for this is that conditions of agriculture make Canada inherently better adapted for the production of a mutton type of sheep than the Merino or essentially fine wool breeds, and the market demands placed upon the mills does not render it profitable for them to utilize the coarser grades at a price which can be gained for them in export. However, the coarse-wooled type of sheep is losing prevalence and the distinctly medium-wooled or "Down" breeds are attaining the greatest prominence and soon will monopolize the market. These produce the class of wool and mutton most acceptable to the domestic trade.

Breeds raised to the greatest degree in Canada belong to the "Down" classes of British origin, namely, the Oxford Down, Hampshire and Shropshire. These breeds represent the foundation stock of the country. The Suffolk Down and Southdown are also bred to a limited degree and are chiefly used for crossing purposes to attain perfection of mutton type and in the case of the Suffolk early lamb, maturity. The Dorset Horn is raised fairly extensively in proximity to cities for the purpose of winter or "hot-house" lamb production. This breed is especially adapted in this form of sheep husbandry, since it possesses the innate quality of taking the male at virtually any period of the year. The Cheviot of Scottish origin is being used in the rough, rocky and hill sections in Northern Ontario and Quebec. Its ability to range and thrive under a state of comparative neglect makes it especially satisfactory for breeding in these districts. The long-wooled British breeds of Lincoln, Cotswold and Leicester were prominent at one time and represented the first breeds to be imported. However, as already explained, the tendency now is toward a medium-wooled mutton sheep and the former have lost their ascendancy, being slowly supplanted by the latter. The Merino, such as the Rambouillet or Delaine, are used only for crossing purposes upon sheep of mutton character, ranged in large flocks over wide areas in the dry farming belts of Saskatchewan, Alberta and British Columbia. The infusion of Merino blood gives the gregariousness and rustling qualities so essential under the conditions. It is found that the British breeds are well adapted to the Canadian climate and agriculture. They are, consequently, being kept in a pure state and confined to areas similar to their place of origin. The

PRESENT STATE OF SHEEP BREEDING IN CANADA

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	Annual Statistics from 1912 to 1916									
	1912	1913	1914	1915	1916	10 Year Totals from 1901 to 1911				
<i>Whole of Canada</i>	3 153 509	3 048 614	3 563 741	3 310 339	3 125 202	3 042 241	3 154 531	2 854 845	2 024 661	1 965 101
<i>Provinces</i>										
Prince Edward Island	166 497	147 672	125 546	91 232	87 793	85 666	85 351	86 640	88 797	
Nova Scotia	908 377	377 801	331 192	285 244	220 907	210 135	217 734	211 021	205 542	200 979
New Brunswick	244 118	321 163	182 941	182 824	158 216	148 723	135 115	211 730	111 026	105 997
Quebec	1 067 800	850 233	730 287	651 003	637 002	620 881	602 751	571 287	554 491	497 711
Ontario	1 514 014	1 350 178	1 021 569	1 040 456	943 483	677 462	705 848	640 416	611 789	589 581
Manitoba	—	6 073	38 838	20 404	37 322	40 800	42 840	45 303	50 850	51 943
Saskatchewan	—	—	—	160 048	111 216	114 810	115 568	126 027	133 311	138 350
Alberta	—	—	—	87 104	133 502	135 075	178 015	211 001	238 579	245 474
British Columbia	—	20 172	32 105	33 350	39 272	40 702	45 000	45 000	46 404	46 269

is no apparent necessity, therefore, to create purely Canadian classes of sheep except where ranching obtains in Western Canada.

A control of the distribution of the British breeds mentioned is expedient and is being carried out. For instance, it would be inadvisable to raise the Oxford Down in a mountainous region. Such a region is plainly the place of the Cheviot. Experiments, however, are under way to discover and produce a type of sheep, purely Canadian and suited for ranching purposes in the Western Provinces. The ultimate product will comprise some cross of the Merino with the essentially mutton types.

Sheep are raised in small flocks, averaging twenty-five head, in the Eastern provinces and Manitoba, except for a limited degree of ranching in Northern Ontario and Quebec, where an average of 1000 head will comprise a flock. In Northern Saskatchewan, Alberta and British Columbia except the undeveloped section of the latter, the same character of sheep raising is pursued. In the remaining parts of these provinces ranching of sheep in flocks as high as 15 000 head is carried on profitably. Ranching occupied a much more prominent position than it does today. The homesteader or settler is slowly taking up the land, with the aid of irrigation where necessary, and encroaching upon what were the preserves of the rancher so that he is compelled to restrict the size of his flock. However paradoxical it may appear, this condition makes for an increase in sheep population. Where the rancher carried one sheep on many acres the farmer will raise several sheep per acre and the animals will be of a higher character.

For some years Canada will not be an exporting country of sheep products. That it eventually will be and on a large scale is assured. It soon will supply the demand for home consumption in mutton. The finer grades of wool will always be imported, but shortly an offering for export in relatively large quantities will appear of the medium and coarse classes, since, when settled, the boundless areas of uncultivated fertile farming lands which exist, will cause agriculture and its kindred industry live stock production and especially sheepraising, to develop at a great pace than the establishment of those classes of manufacture upon which the progress of agriculture is not strictly dependent.

SECOND PART. ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

§ - Agriculture in the Dominican Republic — ZIELINSKI, C. M. J., in *Supplement to Commerce Reports, Annual Series*, No. 26a., pp. 1-3, Washington, D. C., May 5, 1917.

The Dominican Republic has an area of nearly 20 000 square miles, being about twice the size of the Republic of Haiti or more than five times that of Porto Rico. The latest estimate of the population is 700 000. The fertility of the land, which is mainly in the virgin state, presages the possibility of immigration and consequent development provided, of course, other factors remain equal.

The climate of the country is healthy, like that of Porto Rico and other large islands in the West Indies. Trade winds blowing most of the year make the nights cool, and only a short part of the day can be called hot. From early December until June there is very little rain, and the weather is therefore ideal for the grinding of sugar cane. Considerable rain falls in the central and northern part of the Republic, especially in the vicinity of Samana Bay, which is probably the most fertile section of the entire country. In 1916 was recorded an abnormal rainfall for the southern section, when the precipitation from October 1 to November 23 totaled 22.67 inches, more than three times that of 1915 and about seven times that of 1914.

One of the most important products of the Republic is sugar, produced mainly in the southern half. The 1916 crop, although about equal to that of 1915, brought excellent profits. The 1917 crop, estimated at about 2000 long tons, is considerably more than the one preceding. The increase is suggestive as to the immediate future. This island lies between Cuba and Porto Rico, both of which are large sugar producers. If it is considered that the local industry is able to increase its exports to the United States while paying the full import duty in competition with the 20

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OF
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IN DIFFERENT
COUNTRIES

per cent. reduction of duty on sugar from Cuba, and even against free transportation from Porto Rico, it will be recognized that the conditions are good, to say the least. A new sugar plantation was established during the year. Negotiations are now on foot to utilize the land near Barahona for the growing of cane, and it is probable that the entire southern part of the island will be devoted to the sugar industry.

Another product is coffee, of which Santo Domingo exports more than any other Dominican port. Cacao is the chief product of the northern half and much of it is grown around Samana Bay and shipped from Sanchez. Tobacco is grown mainly in the central part and exported chiefly through Puerto Plata. The grade of tobacco raised is good, although its quality is diminished by careless growing and curing. The value of the crop is a means of widely distributing money among the people is great, thus inducing a more general prosperity.

The following table shows sections of the Republic producing the four main crops, which comprise 90 per cent. of the total exports of the country. It also contrasts the value of the product in each locality with the figure of the previous year.

Ports	Cacao		Coffee		Sugar		Tobacco leaf	
	1915	1916	1915	1916	1915	1916	1915	1916
	\$	\$	\$	\$	\$	\$	\$	\$
Azuza	—	—	37 479	21 576 ¹	284 051	545 279	—	—
Barahona	—	—	9 179	12 924	—	—	—	—
Comendador	—	—	—	—	—	—	26 704	—
Dajabou	—	—	—	—	279	—	14 350	—
La Romana	260 839	112 654	163	—	—	—	—	—
Las Lajas	—	—	11	—	—	—	—	—
Macoris	234 016	279 000	1 022	—	6 071 120	1 616 024	160	—
Moate Cristi	1 756	—	7 233	3 302	95	—	15 199	—
Puerto Plata	924 113	916 950	145 357	91 378	—	3 421	140 299	—
Samana	208 876	187 735	—	—	—	—	—	—
Sanchez	2 964 642	4 249 970	47 146	13 594	—	—	271 542	—
Santo Domingo	269 462	212 360	210 512	166 083	1 315 838	1 863 573	119	—
Totals	4 863 254	5 558 649	458 431	316 827	7 671 383	12 028 207	922 869	148

The Dominican Republic has rich forests, which are hardly diminished by the drafts made during the four centuries since its discovery. The wooded area is estimated at 9 500 000 acres, about 85 per cent. of the total land surface. Mahogany was formerly exported in considerable quantities and is known for its excellent quality. Pine covers a large area in the central and southwest parts. Lignum-vitae is plentiful, especially in the south. There are immense quantities of dyewood in the interior. According to reliable reports, the north seems favoured with a greater quantity and the south seems to have the better quality. The scarcity

in the United States has prompted many local firms to take advantage of the conditions and much logwood has been shipped to American markets.

Agriculture in the Philippines.—*Commerce Reports*, No. 154, pp. 28-31. Washington, D. C., July 3, 1917.

Few authoritative figures have ever been published regarding agriculture in the Philippines. This fact lends special importance to data collected by the Philippine Bureau of Agriculture and now made public by the Bureau of Insular Affairs at Washington.

The total area of the Philippines, including in all 3 141 islands, islets, and reefs, has been reported by the Manila Observatory to be 119 542 square miles, which is equivalent to 30 961 500 hectares (1); but the area under cultivation in the six principal crops and three minor ones in the year ended June 30, 1916, was only 2 621 077 hectares, or 8.5 per cent. of the whole area of the islands. Rice was grown on 1 140 829 hectares, sugarcane on 500 317, corn on 432 766, coconuts on 275 769 (the average bearing being 200 trees per hectare), sugar cane on 179 761, tobacco on 913, and maguey on 30 804 hectares. There were 1 074 hectares devoted to cacao and 844 to coffee.

The reported yield from this area and the value of the crops (expressed in Philippine pesos of \$ 0.50) are given as:

Products		Amount produced	Total value in municipal markets, pesos
Abaca (Manila hemp)	kg. (a)	152 766 278	42 767 339
Cacao	" (b)	558 357	345 059
Coconuts and coconut products:			
Rice-nuts for food	number	63 818 406	2 177 343
Copra	kg.	141 764 143	19 016 096
Oil	liters (c)	2 688 305	713 288
Tuba (toddy)	"	53 938 612	2 524 228
Coffee	kg. (b)	752 156	361 754
Corn, shelled	liters	496 270 874	14 723 062
Maguey (cantalua)	kg.	13 389 722	1 747 263
Rice, rough	liters	1465 914 892	55 923 821
Sugar and sugar-cane products:			
Crude sugar	kg.	350 281 946	31 283 764
Paochos (small cakes)	"	23 736 795	2 173 908
Basi (a beverage)	liters	6 783 324	500 560
Molasses	"	2 216 638	177 812
Tobacco leaf	kg.	41 139 174	7 259 160
Total			181 695 456 pesos

a) kg. = 2.2 lbs.; b) Estimated; c) Liter = 0.981 dry quarts or 1.0567 liquid quarts.

The area devoted to fruit trees, bananas, and camotes (a variety of sweet potato), ubi (the uvi yam), gabe (= taro) and other vegetables

1 ha. = 2.471 acres.

is not included, as complete crop statistics for these products are not available.

Abaca (Manila hemp), sugar, copra, and tobacco are the four leading export crops.

The rice crop, which ranks first in point of value, is not sufficient for home needs, and large quantities of this cereal are annually imported into the archipelago, though the Philippine Bureau of Agriculture is endeavoring to extend its cultivation.

Of the area under abaca cultivation in the fiscal year 1916, only 311,675 hectares were harvested, the average yield per hectare being 460 kilos. Albay, Ambos Camarines, and Sorsogon Provinces, in the island of Luzon, and Leyte Province, in Leyte Island, are the leading producing centres, Leyte having the largest average yield.

Occidental Negros is the leading sugar Province, with Pampanga, Batangas, and Iloilo next in order as regards cane area, these four Provinces having, respectively, 29.8 per cent., 16.1 per cent., 8.4 per cent., and 8 per cent., of the total area under cane cultivation in the year ended June 30, 1916. In value of their products Occidental Negros again ranks first, with 40 per cent.; Pampanga is second, with 13.1 per cent.; Iloilo is third, with 7 per cent., and Batangas fourth, with 5.3 per cent. Cebu and Oriental Negros were the only other Provinces whose output of sugar-cane products in the year under review exceeded 1 000 000 pesos; the former furnished 31 per cent. of the total value from 3.6 per cent. of the total area under cane cultivation, the latter 3.2 per cent. of the value from 2.4 per cent. of the land. The value of all sugar-cane products was 34 136 134 pesos, made up of "Crude sugar" which includes sugar in pilones (bell-shaped earthen shells), sugar in "bayones" (sacks), and bulk sugar; "panochas", which are small cakes of unrefined sugar, ranging from $\frac{1}{2}$ kg. to one kg. in weight, and of the favourite form of handling sugar for local consumption; "basi", which is a beverage made from the juice of the freshly cut cane stalks, in molasses.

The coconut is already cultivated in many parts of the Philippine Archipelago, but the improvement that is now being effected in the quality of the copra produced in the islands should, in view of the great world demand for oilseeds, produce a further expansion of the industry. Of the 54 153 847 trees reported by the officials who made returns to the Bureau of Agriculture, 299 103 were tuba trees producing 180 litres annually per tree, 24 133 909 were trees too young to bear fruit and 29 720 835 were bearing trees averaging 25 nuts per tree per year.

Isabela Province, in the Island of Luzon, is the chief grower of tobacco in the Philippines, having 37.1 per cent. of the total area, producing 5 per cent. of the total yield and contributing 44.7 per cent. of the total value of this crop in the year ended June 30, 1916. Cagayan, which ranks second, had only 16.4 per cent. of the area and produced 16.6 per cent. of the total output in that year, but contributed 19.2 per cent. to the total value.

90 - Value of Poultry for Rural Hygiene. — PERRONCRO, A., in *L'Economia rurale*, Vol. 50, Part. 10, p. 239. Turin, August 25, 1917.

It has been stated (1) that flies pass their larval stages only in horse manure and not in the mixture of litter and cattle dung. In contradiction to this, however, the writer has constantly observed that the larvae of flies develop in this latter. When litter and cattle dung have been placed in a heap the larvae appear in groups of hundreds or thousands at a time between the layers of the litter in places where it has become damp and converted into manure. Poultry of all ages are fond of turning over manure as it leaves the stable in order to find larvae and remnants of food occurring between the layers of litter; the voracity with which poultry destroy the larvae is a very important factor in rural hygiene.

91 - The Relation between the Hatching of the Eggs and the Development of the Larvae of *Stegomyia fasciata* (*Aedes calopus*), and the Presence of Bacteria and Yeasts. — ATKIN, E. E. and BACOT, A. (Of the Lister Institute of Preventive Medicine), in *Parasitology*, Vol. 9, No. 4, pp. 482-536. London, July, 1917.

The clearing action of mosquito larvae in turbid water and their scarcity or absence in clean water, is an old-established popular belief in mosquito-bitten districts of both the old and the new world. Scientific workers have also remarked the relationship existing between the development of bacteria and the growth of the larvae.

The present paper describes a large number of experiments devised by the writers to test the effect of various bacteria and of yeasts upon the hatching of the eggs and the development of the larvae of *Stegomyia fasciata*.

The conclusion of the writers respecting the evidence as a whole is stated as follows: that the larvae of *Stegomyia fasciata* greedily consume both bacteria and yeasts on which they can thrive in the absence of any other food, whereas in very many instances they fail entirely to develop on a variety of nutritive fluids and particles, including dead bacteria, under sterile conditions. In the far less numerous cases where progress was made under apparently sterile conditions, growth was always relatively very slow compared with that under otherwise equivalent but unsterile conditions, and the mortality was very high. The rearing of adults under sterile conditions being so exceptional, the writers feel justified in stating that the presence of bacteria or yeasts is a practical necessity for the maintenance of the species. The ingestion of larger particles and the structure of the jaws are not incompatible with this view, because such particles are likely to be covered with a bacterial growth while the jaws are of use in gnawing away portions of decaying organic matter.

It seems probable that this knowledge may be of assistance in the destruction of this species of mosquito, as it should enable the methods now so largely available for the purification of water from bacteria to be utilized. It may also be of service in enabling Sanitary Officers to escape the annoyance caused by the failure to breed more than one or two isolated species from jars containing mosquito larvae captured by their inspectors. This failure

(1) See *B.*, 1915, No. 1119, and *R.*, 1916, No. 1317.

(E.E.).

no doubt arises owing to starvation, because the bacteria are killed by the action of light, it being customary to stand jars with "wrigglers" in the full light of a window. There is the further possibility that the eggs, at a careful and probably lengthy research, might be found to be of service as a rough and ready means of testing the relative purity of water in respect to living organisms.

892 - Observations on the Influence of Salt and other Agents in Modifying the Sexual Development of the Hook-Worms *Ankylostoma duodenale* and *Necator americanus*. — NICOLL, WILLIAM (Australian Institute of Tropical Medicine, Townsville, Queensland). In *Parasitology*, Vol. 9, No. 2, pp. 155-159, London, February 1917.

An account of the life-history of hook-worms under normal and abnormal conditions, followed by a description of experiments undertaken with the object of determining the action of common salt and other agents upon the development of hook-worm eggs and larvae in their different stages.

The following are the chief conclusions:

The chief preventive measures are individual cleanliness and thorough and rapid destruction of night soil and deposits of faecal material.

In the presence of a properly organized sanitary system, intelligently utilised, there should be little or no risk of infection. If the indiscriminate deposit of faecal material be not prevented, the matter becomes a problem of considerable difficulty.

The more commonly used disinfectants, if thoroughly employed, will render the faecal matter comparatively innocuous, but their use is not laborious than the proper removal of faecal matter and its disposal in properly constructed receptacles.

Common table salt has a decidedly injurious effect upon the hook-worm eggs but it requires to be brought into very intimate contact with infected material. The process of merely sprinkling the surface is almost futile unless the salt be used in enormous quantities.

When mixed with faecal matter, sand promotes the development of hook-worm larvae, but when used as a covering of a certain depth it retards development.

Exposure to direct sunlight of sufficient intensity kills hook-worm eggs and larvae very rapidly.

EXPERIMENTAL
AND
ANALYTICAL
WORK

893 - Farming Practice in the Sand Hills Section of Nebraska. — COWAN, JAMES. *The University of Nebraska Agricultural Experiment Station, Bulletin No. 1359*, 1916. Lincoln, Neb. 1916.

This bulletin covers the experimentation undertaken during the five years at the Valentine Substation, established in 1910 for the purpose of aiding settlers and farmers in the Sand Hills district.

The Sand Hills region of Nebraska stretches nearly three hundred miles, extending westward from about 98° west longitude. Its north boundary is the Niobrara River and its southern boundary the North Platte River. Of the total area of 20,000 square miles, there is not at the present time more than 200,000 acres that is not settled, and there are now sections of 640 acres open to homestead entry.

Generally speaking the chief characteristics of the Sand Hills which affect farming are a light sandy soil, small precipitation and extreme variations of temperature. The Sand Hills country is primarily a cattle raising country, but the Kinkaid Act giving 640 acres for a homestead, instead of 160 acres as under the old homestead act, has attracted settlers in large numbers, and many of these are farming in favourable localities with considerable success.

The dry valley bottoms and the better portions of dune sand land are the principal farming lands of the Sand Hills country. Under cultivation, this land needs above everything else preservation of humus or organic matter to enable it to retain moisture and to prevent the blowing of the soil.

No method of improving the range land in the Sand Hills country by the introduction of new grasses has been discovered, but the native herbage rapidly improves if it is not overgrazed and if fires are kept from running over it. The pasturage on the ranges is of good quality. The hay or winter feeding, while not equal in nutritive quality to the range grasses, can be readily and cheaply improved by growing red and alsike clover among it; also winter forage can be greatly improved on the drier farming lands by growing alfalfa. The work done at the Valentine Substation has proved that alfalfa can be grown in most sections of the Sand Hills country, and it is recommended that, where possible, it should be made to take the place of intertilled forage crops, because it would do away with the danger of soil blowing. Experiments have shown that for this section alfalfa exceeds all clovers, including sweet clover, (*Melilotus alba*) in its adaptability to conditions. Sweet clover has been found more adapted to arid lands than to Sand Hills lands. Sudan grass has yielded as high as 1667 pounds of hay on light sandy soil, when sown in rows 21 inches apart. Sown broadcast it yielded 1649 lbs. per acre. It is much relished by stock.

None of the other varieties of grain sorghums tested at the Valentine station equalled the upright headed dwarf milo in yield. The yield amounted to 11.2 bushels per acre on light soil in 1913, this being the highest recorded yield of three years' investigation. Feterita is a good yielding grain sorghum and stands drought well, but has not fully matured on the lighter upland soils. As a forage crop it is not relished by stock. The late variety known as Minnesota No. 13 gave heaviest yields, 13.6 bushels per acre under conditions similar to those in which milo gave a yield of 11.2 bushels.

The Irish Cobbler potato has outyielded all other potatoes in tests covering three years. The best depth to plant in light sandy soil is from 4 to 5 inches. The best yields were obtained with rows spaced 42 inches apart and 24 inches in the row. The most profitable size of sets was medium quartered. Potatoes grown on light sandy soil under a mulch of 6 inches of hay yielded 50 per cent. more than when grown in the ordinary way.

Where a sufficient supply of manure is not available, or where owing

to scarcity of moisture the ground is not capable of absorbing or assimilating sufficient manure, a rotation of crops that maintains the humus organic matter in the soil is desirable.

For tree culture in the Sand Hills country clean cultivation and preservation of an earth mulch is much more essential than watering. The best quick-growing varieties of trees are Norway poplar, cottonwood, box elder; of the slower growing deciduous trees the American elm and honey locust have done best. Among trees of the coniferous order, pines (*Pinus ponderosa*) have done best.

Spirea Vanhouttei has made the best lawn shrub under Sand conditions.

Orchard trees when unsheltered from prevailing winds, or dependent on precipitation alone for moisture, are as a rule not successful. Vegetables grow splendidly in the valleys and in sheltered places where they are irrigated or where there is subirrigation.

In laying down a lawn in the Sand Hills, well-rotted manure should be liberally applied and the seed should be sown early, using a mixture of some tender grass which will kill out when frost comes. In watering the same principle as applies to trees is applicable. A lawn should be soaked not sprinkled.

CROPS AND CULTIVATION.

AGRICULTURAL
METEOROLOGY

894 - **The Freezing of Fruit Buds; Researches made in the United States.** - by F. L. and EDLESEN, N. E., in *Utah Agricultural College, Experiment Station Bulletin*, pp. 2-11, fig. 1-6. Logan, Utah, February 1917.

When plant tissue freezes, water passes out of the cells and forms the intercellular spaces. If the thawing is done slowly enough, the water gradually passes back into the cells, which again resume their function provided the ice has not ruptured the cell wall. If, however, the thawing is done rapidly the cells can only partially reabsorb the water and suffer loss of sap.

Low temperatures thus affect the tissues in two ways: 1) they induce rupture of the cell wall; 2) they kill the cells by causing loss of sap.

The degree of resistance to cold varies in the different species at various periods of their development: 1) according to the degree of the concentration of the cell sap; the more concentrated the latter, the lower the freezing point; 2) according to the dimensions of the intercellular spaces which act as true capillary tubes; in fact, as a result of WALKER'S experiments, it was found that liquid in a capillary tube can be cooled far below its freezing point without becoming solid.

There are 3 ways of combating sudden and great falls of temperature:
1) By selecting types possessing a high degree of specific resistance;
2) By choosing late kinds, in order that the trees may have passed their time of year when frosts are of rare occurrence, and not severe.

3) By directly combating the cold by means of smoke, a method adopted with excellent results in the United States (California, Colorado, Oregon). Each orchard is furnished with a certain number of receptacles, arranged in the most suitable manner and filled with heavy oils which, when burning, produce a thick cloud of hot smoke that envelops and protects the plants while also preventing any loss of heat by radiation.

The meteorological stations, which are in communication, predict with great exactitude the approach of the cold waves and inform the fruit-growers in time to light the heavy oils in the receptacles at the right moment. This method, though reasonable and practical, is very costly and is usually only applied in cases where the result is practically certain. Thus, the minimum temperature predicted is so low that the rise in temperature produced by the smoke would not be sufficient to prevent freezing, it is best not to light the fires. The same advice holds good in the case of a temperature below the temperature limit. It is, therefore, most important to know the critical temperatures for the various stages of the development of the floral buds of the different varieties of fruit trees. The writers carried out a series of very careful experiments, in order to determine these critical temperatures. The apparatus or instruments, used by them were of three kinds.

1) *For laboratory tests.* — Three cylindrical concentric vessels, one placed inside the other. In the space between the wall of the first (the largest) and that of the second, is put the freezing mixture (ice and salt); the space between the walls of the second and third cylinders is filled with salt solution, the temperature of the latter being kept constant by an apparatus provided with two small electric lamps which are lighted and extinguished automatically. In the interior vessel, or vessels, (for there may be more than one) the branches of fruit buds are placed.

2) *Apparatus for freezing branches in the orchard.* — This consists of two vessels; in the first, which is filled with the freezing mixture, is placed a coil of rubber tubing which is fitted to the opening of the second vessel. Into the latter are introduced the branches of fruit buds; these must be bent, care, however, being taken to avoid breaking them. The second vessel is double-walled, the space between the walls being filled with ice and salt, through the rubber tube passes a current of air at a given temperature.

3) *Apparatus for freezing the entire tree.* — A double-walled half-cylinder made of galvanised iron and fastened on a wooden base on runners. It is 6 ft. high and 6 ft. in diameter; within the two walls is placed the freezing mixture.

In the experiments, the following factors were taken into consideration: 1) The kind of floral buds; 2) their state of development; 3) the duration of the freezing; 4) the rate of thaw; 5) the humidity; 6) the minimum temperature (marked by *BEHMANN'S* thermometer). The injury done by the low temperatures is expressed by the percentage of buds killed.

Table I gives the results obtained with *Elberta* peach buds (laboratory experiments).

TABLE I. — *Results obtained with Elberta Variety of Peach*

No.	Date	No. of buds	Duration	Development	Temperature		Damage
					Degrees F.	Degrees C.	
1		35	30 minutes	In bud	20.0	6.69	0
2		38	10 "	Full bloom	24.0	4.44	0
3		22	80 "	" "	24.0	4.44	0
4		42	5 "	" "	25.0	3.87	0
5		62	15 "	" "	25.0	3.87	2
6		35	10 "	" "	25.0	3.87	0
7		42	40 "	" "	26.0	3.33	0
8		37	40 "	" "	27.0	2.77	0
9		27	20 "	" "	27.5	2.50	0
10	25 April	80	10 "	Fruit setting	21.5	4.11	0
11	26 "	16	10 "	" "	26.0	3.33	0
12	25 "	70	10 "	" "	26.5	3.05	40
13	26 "	49	10 "	" "	27.0	2.77	0
14	26 "	78	20 "	" "	27.5	2.50	0

Many experiments have been made with the Jonathan variety of apple and with Double Nattie cherries. The following are the most important results obtained:

1) There is a range of at least 5° F. (2.77° C.) between the temperature at which only about 5 per cent. of the buds are damaged, and the temperature that will kill all of them.

2) In the case of Double Nattie cherries, when the fruit is setting 29° F. (— 1.66° C.) caused no damage and 24° F. (— 4.05° C.) killed practically all of them.

3) With Jonathan apple blossoms in full bloom, 28.5° F. (— 1.5° C.) caused no damage and 24° F. (— 4.44° C.) killed about half of them.

4) The results obtained in the case of the prune tree are set forth in Table II.

TABLE II. — *Test of Hardiness of Prune Buds to Frost.*

No.	Date	No. of buds	Duration	Development	Temperature		Damage
					Degrees F.	Degrees C.	
1	25 April	143	12 hours	Full Bloom	21.0	6.10	0
2	25 "	101	15 minutes	" "	24.3	4.13	0
3	25 "	160	15 "	" "	27.0	2.77	40
4	26 "	67	15 "	" "	28.3	1.94	0
5	1 May	30	25 "	Fruit setting	25.3	3.93	0
6	" "	30	25 "	" "	27.3	2.39	40

5) The susceptibility of floral buds varies during the course of their development, and reaches its maximum values during fruit-setting. The temperatures which will kill about 50 per cent of the Elberta peach buds are as follows: 14° F. (− 10° C.), when they are slightly swollen; 18° F. (− 7.77° C.) when well swollen; 24° F. (− 4.44° C.) when they are showing pink; 25° F. (− 3.89° C.) when in full bloom; 28° F. (− 2.22° C.) when the fruit is setting.

The Resistance of Certain Ornamental Plants to Frosts, in England.—See No. 909 of this Review.

Measurement of the Inactive or Unfree Moisture in the Soil by Means of the Dilatometer Method.—BOUVROCOZ, G. J., in *Journal of Agricultural Research*, Vol. VIII, No. 6, pp. 205-217 + 1 fig. Washington, D. C., February 1917.

It is possible to determine with the help of a dilatometer, the amount of water in a soil which does not freeze when it is kept at − 3° C. Different samples of soil were tested, from a quartz sand to a black heavy clay. Each sample was prepared by adding 5 cc. of distilled water to 25 gm. of air-dried soil. After the soil was placed in the bulb of the dilatometer, the bulb was completely filled with the ligroin, freed from all air, and then placed in a cooling mixture the temperature of which was maintained at − 4° C. When the contents had attained the temperature of − 3° C. the dilatometer was moved gently in the cooling mixture until solidification commenced, the expansion was measured when equilibrium was reached. It was found that the amount of added water that failed to freeze varied from 12 per cent. in the case of quartz sand, to 80 per cent. in that of heavy clay and that, as a rule, the more colloidal the soil, the smaller the amount of water that froze.

The values obtained by the method in question correspond remarkably closely to the moisture content, known as the wilting coefficient; to the percentage of moisture at which solidification cannot be started; to the micritic moisture content, etc. (1). This water which fails to freeze is designated as unfree or inactive water. Many evidences indicate, however, that a large portion of it may exist as physically adsorbed or chemically bound in a more or less unstable manner. Any how, this inactive water is in an absolutely unchangeable condition, but can be converted into available water, by various factors or treatments: thus in colloidal soils the free water decreases with the increase in supercooling, the same is produced by increasing the moisture content of the soil, and also by successive freezings.

The writer is continuing his investigations on the subject. Appended to the article is a bibliographical list of 9 works.

The Transposition of Sesquioxides in Forest Soils, Especially in View of the Formation of *Allos* (Ortstein) and of *Laterite*.—STREMMER, H., in *Kolloid Zeitschrift*, Vol. XX, Part 1, pp. 161-168, Dresden, 1917.

The writer examines the theory of the formation of ferric oxide and of *Allos* in the soil, according to which this formation would result from the

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1. See also *R.*, 1916, No. 8.

coagulation of the corresponding "sols", that is to say, from their colloidal solutions. He studies their relations with the physico-chemical composition of soils and with the physiographical environment, vegetation and climate for the temperate and tropical zones.

He notes, first of all, that the composition of the soil solution is one of the principal factors in the process of coagulation, especially as regards the content of organic substances. The course of the phenomenon is the same for the forest soils of the temperate zones as for those of tropical regions, whether one is concerned with the formation of alios (Ortstein) or with that of laterite and of "red soil": the "sols" viz. the colloidal solutions of their humus, alumina and iron oxides are carried off into the subsoil, where they are precipitated and eventually decompose. The intensity of the phenomenon depends partly upon the activity of such agents as water, humus, atmosphere, heat and also the colour of the soil, i. e. the phenomenon is more intense when the soil is dark red instead of being yellowish red or yellowish brown.

898 - **Some Observations on the Occurrence of Infertility under Trees in India.** - TINDRA NATH SEN (Agricultural Chemist), in *The Agricultural Journal of India*, Vol. XX, Part III, pp. 390-405, plates XXXIII-XXXVII, tables 8, Calcutta, July, 1927.

It is well known that trees often give rise to the formation of infertile patches round themselves. The theory of shade which is usually adduced does not wholly explain the phenomenon. In the first place the affected tract of land does not always coincide with the shade-limit and secondly lands under bamboos are known to remain infertile even after the removal of the clumps - the source of obstruction of the sun's rays.

Pot experiments with plants grown in soil taken from under a tamarind tree showed that the "tamarind soil" contained something which was evidently positively harmful to plant growth. In this case, the effect was found to be due to the accumulation of an excessive amount of salts, but this is not invariably so. The nature of the salts is also of importance, some salts being more toxic than others.

This accumulation of soluble salts might be due partly to the leaching out of the mineral matter in the dead remains of the plant (decayed roots or fallen leaves) but transpiration of the plant is likely to be an important factor. A growing tree transpires an enormous amount of water. These have to abstract this water from the soil particles with which they come in contact. On account of the soil near about the roots thus getting drier than the rest of the mass of soil, there sets up a movement of water from the wetter to the drier zone to restore the equilibrium. This movement goes on continuously with the growth of the tree. Along with the water, the dissolved salts present in the soil solution also move towards the tree.

On this assumption, plants having a high transpiration ratio would produce harmful results quickly. It may be that plants having thin small leaves - tamarind, "pipal" (*Ficus religiosa*) - transpire relatively more water than trees having thick leaves - "bar" (*Ficus bengalensis*). The extent and the distribution of the root-system are also of importance. Plants having a smaller root-range relatively to the transpiration would

course, effect a greater local concentration of salts. Again, the injurious effect may be apparent soon if the roots are mostly in the top layers of soil. These considerations might probably hold in the case of bamboos. Other factors are competition for sunlight and plant food and inability to get rid of some of the injurious products of the vital activities of the plant (including carbonic acid) sufficiently rapidly.

With regard to remedies in such cases of infertility, the removal of the plants is the first step. After this, attempts should be made to effect a permanent improvement in the texture of the soil by means of deep cultivation and the addition of organic manures. Proper drainage facilities should be provided so that the salts may readily pass out of the soil. In some cases it may be necessary to have recourse to an efficient system of irrigation (combined with suitable drainage) to get rid of the accumulated salts.

Investigations in Cost and Methods of Clearing Land. — THOMPSON, M. J., in *The University of Minnesota Agricultural Experiment Station Bulletin No. 163*, pp. 1-52, University Farm, St Paul, Minnesota, September 1916.

Results of investigations, relating to cost and methods of preparing cut-over timber lands for farming purposes, carried out at the Minnesota Northeast Demonstration Farm and Experiment Station, near Duluth.

Fifteen acres of cut-over timber land were divided into three tracts of 5 acres each. On tract I the clearing was forced with dynamite; on tract II the stumps were first split with small charges of dynamite and then pulled with a machine; tract III after being brushed out was seeded to clover and timothy pasture, and clearing with dynamite was postponed five years until 1918.

The conclusions thus far arrived at may be stated as follows:

1. Cost (1) and method are determined largely by the character of the land and the kind of vegetation.

2. The returns in forest products (\$ 43.53 per acre) covered practically the cost of brushing and other cleaning work (\$ 46.53 per acre) up to the stumping stage.

3. The cost per stump for blasting (\$ 0.06 per stump) and pulling (\$ 0.04 per stump) on tract II was almost identical with the cost of explosives alone (\$ 0.11) on tract I.

4. The cost of clearing was much less on tract I (\$ 0.04 per stump), because much less labour was required in piling and burning the stumps (\$ 0.10 per stump on tract II).

5. The cost per stump for removal was least for the man-power machine (\$ 0.06), slightly greater for the horse power machine (\$ 0.12) and greatest for dynamite (\$ 0.14) (This was for green timber and did not include the cost of piling which makes the use of dynamite the cheapest method by a good margin).

OPENING-UP
LAND FOR
CULTIVATION

* Price of man labour 20 cents per hour and of horse labour $7\frac{1}{2}$ cents per hour (horses hauled only the entire year thus reducing the cost per hour).

6. Some relation may apparently be established between the size of the stump and the size of the charge required to remove it.

7. The man-power puller will work to best advantage on the small farm, where the farmer has very limited means.

8. Under average farm conditions dynamite is usually to be preferred to the stump puller either alone or in combination. However, the plan of clearing being followed on tract III will not only be carried out at a lower cost as predicted, but is actually giving a larger net return in pasturage the first year than has been realized from the first crops from land on which the clearing has been forced. This is because forced clearing requires more labour and because land cleared by this method is relatively lacking in humus which curtails yields.

9. Following the removal of stumps from cut-over timber lands, on account of the shallow covering of vegetable matter, care should be taken to plough shallow the first time and to take immediate steps to increase the humus by seeding the land to clover and grasses, using barley or oats for a nurse crop.

The work from which these deductions were made was done on land which averaged more than two hundred stumps to the acre. These had a diameter of about 12 inches at the base and 10 inches at the cut-off.

Sixty per cent of the timber was green. The lower grades of dynamite were used on all kinds of stumps except green birch.

Analytical data presented include:

Cost of clearing expressed in units of time and in units of exchange.
— Detailed study of the various stages of the clearing work. — Forest products, a credit in cost of clearing work. — Relative cost and efficiency of dynamite alone and in combination with a puller. — Individual stump studies. — Standardization of charge, based on size, kind, condition, and location of stump. — Comparative study of dynamites of various strengths. — Special study of the man-power puller. — Land clearing practice. — Farm development.

The Society of Natural Sciences of Wageningen, Holland, organized experiments in order to test the value of the divining rod. Four diviners took part in the tests which consisted: 1) of tracing underground streams and controlling their courses in a given plot; 2) of determining whether underground conduits were full of water or dry. The results showed that in many cases it was probable, and in some cases certain, that the rods react to some apparently existent conditions. This shows the apparent success of diviners to be due to superficial control, and their observance and experience of the ground.

Completely unfavourable results were obtained in searching for predetermined water-currents; correct answers were obtained in 23 cases and wrong ones in 25. The results of the experiments were, therefore, in opposition to the claims of diviners.

This conclusion agrees in every way with that of Prof. WEBER on practices of German water-diviners.

Dry Farming Investigations at the Sherman County Branch Experiment Station. — STEPHENS, D. E. and HILL, C. E., in *Oregon Agricultural College Experiment Station, Bulletin* 111, pp. 47, 39 tables, 13 figs. Moro, Oregon, April 1917.

METHODS
OF SOIL
CULTIVATION

Besides the experiments with spring cereals carried out at Moro (1), her experiments with winter cereals and other cultivated plants were there and continued from 1911 to 1916 inclusive. The meteorological observations given in this bulletin cover the period from 1911 to 1916. The experiments included: 1) varietal tests; 2) selection; 3) crop rotation; 4) methods of soil cultivation.

Winter Wheat. — 44 varieties were tested. Those belonging to the group of the Turkey and Crimean varieties gave the highest yields. These are the varieties chiefly grown in the west of the United States where winter wheat does well. They have a high milling value, and amongst them found the wheats most resistant to cold. They are also very resistant to drought and are found in all the districts where dry-farming is practised; where there is a heavy rainfall Turkey wheats are not grown.

In experiments carried out over 4 years the average yields of the Argentine (32 bushels per acre), Kharkov (31.2 bushels per acre), Alberta Red (31 bushels per acre) varieties, exceeded the local Turkey varieties by from 15 to 18%.

The experiments show the best time for sowing winter wheat to be between the 10th. and 25th. October. An average of from 45 to 55 lbs. seed per acre was used. In dry soil, or where sowing is late in the autumn, these quantities must be increased.

Barley: Winter Barley. — This is not so resistant to cold as winter wheat. Many varieties were tested, but only 5 were retained. These are given below, together with the average yields obtained:

No.	Variety	Yield per acre (bushels)
1	Texas winter	47.0
2	Maryland winter	45.0
3	Tennessee winter	42.1
4	Chevalier	39.5
5	Utah winter	36.5

In 1916 a new variety, Trebe (936), was tested as a spring barley, and gave a yield of 65.8 bushels per acre.

The results of the experiments with different varieties of spring wheat, spring barley, oats, spelt and emmer described, have been published in the *U. S. Department of Agriculture, Bulletin* No. 408, and the 1916 results do not differ from those previously obtained.

Field Peas. — The Lima, White Canada, O' Rourke, Solo and Carleton varieties gave the highest yields. The average for 4 years is 22 bushels

per acre. Grown in the same field during 4 consecutive years, the yield was 18.8 bushels per acre.

The yield of spring wheat following on field peas was about equal to that obtained when wheat is grown on fallow land.

Maize. — The best results were obtained with Walla Walla White Dent, Min. No. 13, Northwestern Dent and Brown County Yellow Dent varieties.

Potatoes. — The highest yields were obtained with the Green Mountain Pearls and Early Rose varieties.

A great many cultivation methods were tried for growing wheat under the summer-fallow-system. The results obtained so far prove that:

- 1) Autumn disking, if the stubble is heavy, is not profitable.
- 2) If ploughing is done early, spring disking is of doubtful value if the stubble is short.
- 3) Spring disking increases the yield of winter wheat if ploughing is deferred in the spring.
- 4) A farmer loses from 1 to 2 bushels of wheat per acre every year if his ground is left unploughed after April 1, if the ground has not been well disked and all plant growth destroyed.
- 5) Ground ploughed in autumn with a mouldboard plough will give slightly higher yields than ground ploughed in autumn with a disk plough.
- 6) Early autumn ploughing, when the ground is dry, will give high yields as late autumn ploughing when the ground is wet.
- 7) Deep ploughing (8 to 9 inches) will not give higher yields of spring wheat after summer fallow, than shallow ploughing (4 to 5 inches).
- 8) Yellow berries (grain rich in starch) in Turkey wheat are more prevalent on ground ploughed late, without being disked before ploughing than on ground ploughed early in spring. This discovery is of great importance.
- 9) Subsurface or surface packers do not increase the yield of winter or spring wheat after summer fallow.
- 10) Allowing weeds to grow in the summer fallow reduces the wheat yields.

11) Harrowing winter wheat in the spring is of no benefit unless it destroys weeds. With normal wheat stands, no increase in yields has been obtained when winter wheat has been harrowed in the spring.

In the rotation experiments the highest yields of spring wheat were obtained after a summer fallow. The yields of spring wheat following field peas and potatoes, were nearly as high as those obtained after summer fallow. Following maize, spring disked, the yields of spring wheat were 10 bushels per acre less than following summer fallow.

No important increase was obtained in the yields of a crop of grain or maize when the previous crop had been turned under for its manure.

The yields of spring wheat, oats, barley and maize, in 1916, on ground which grew alfalfa for 2 years and was left fallow for 1 year, were not so high as on ground which had been alternately cropped to grain and left fallow. Cooperative trials were made by farmers with seed obtained from

Branch Station. These showed that the highest yielding varieties at the Branch Station, when grown by farmers, will give equally favourable results over a large dry-farming area.

22 - **Wheat Cultivation by Hoeing.** — See No. 914 of this *Review*.

23 - ***Crotalaria usaramoensis* as Green Manure in Java.** — VAN HELTEN, W. M., in *Mededeelingen uit den Cultuurtuin*, No. 6, 1 fig. Buitenzorg, 1917.

MANURES
AND MANURING

This plant has already been mentioned by the writer in *Mededeelingen uit den Cultuurtuin* 1915, No. 2, under the name of *Crotalaria Muvussi* (1), having been received under this title from Annani. BACKER, however, has now classified it as *C. usaramoensis*.

On land of the Buitenzorg (Java) experimental Garden, where other plants usually employed for green manure: *Vigna sinensis*, *Centrosema Plumieri* and other species of *Crotalaria*, had only given mediocre results, *C. usaramoensis*, on the other hand, was surprisingly successful. Sowing was done on April 5, 1916; at the end of 3 months, as the soil was again completely covered with weeds, it was given a couple of hoeings. The 1st cut was made on September 20, when the first flowers had begun to appear. A 2nd. cut was made on November 10 and a 3rd. on December 15; this latter was weighed and found to give a crop of nearly 2 tons of green leaves per acre. When left uncut *Crotalaria usaramoensis* may reach a height of 5 feet.

Comparing this plant with others used for green manuring, the writer enumerates the following advantages: 1) the stems remain supple, do not lignify, and rapidly decompose; 2) it produces a greater quantity of green leaves than the plants usually employed; 3) it is more easily adaptable to a poor soil; 4) the young plants are more resistant to rain; 5) it is superior to other species of *Crotalaria* in its resistance to insect attack.

C. usaramoensis is also a profitable forage plant and the writer recommends experiments from this point of view.

24 - **Measures Adopted in England Respecting the Supplies and Prices of Basic Slag.** — *The Journal of the Board of Agriculture*, Vol. XXIV, No. 8, pp. 580-582, London, August 1918.

According to this notice issued by the Food Production Department respecting the supplies of basic slag and its price for the season 1917-1918, the slags which are now available in England for grinding have a lower phosphatic content, so that the supply of high grade slag is much less than was formerly the case. All the suitable slag available is being ground, and the total tonnage is fully equal to what it was before the war. As no export is now allowed, the quantity available for home consumption is in fact much larger, though it is still below the demand. Arrangements are being made in certain cases to grind a low-grade slag, which has not hitherto been used as a manure; it can be economically used on land within a moderate distance of the works.

The Food Production Department, in conjunction with the Ministry of Munitions, has come to an arrangement with makers in regard to maximum prices to be charged for the slag, which vary according to different works. Thus for some slags, the prices per ton for lots of less than 4 tons, free on rail at works, in makers' single 2 cwt. bags, cash, were fixed within the following limits: basic slag, citric soluble 16 per cent. 44s., basic slag, citric soluble, 34 per cent., 72s. The slags made by other firms varied in price from 46s. for slags with 17-20 per cent. phosphates, to 80s. for those with 42 per cent. (1).

905 - **The Nature of Cement Mill Potash.** — NESSELL, R. J. and ANDERSON, E. L. *Journal of Industrial and Engineering Chemistry*, Vol. IX, No. 7, pp. 610-614, Easton, Pa., July 1917 (2).

Up to a comparatively short time ago, the escaping dust and fumes from cement mills, amounting in some cases to 10 tons or more per kiln per day, only constituted a serious problem as a nuisance to be abated in populated districts.

As, on account of the war, the export of potassium salts from Germany to the United States had ceased, methods were devised in the latter country for using these waste products as a source of potash. Among these methods may be mentioned; the use of simple settling chambers of large capacity, bag houses, water sprays and electrical precipitation. The latter, however, is the only one that has received any extended application. The electrical precipitators were originally installed for the purpose of removing the cause of complaint and litigation on account of the damage caused by the dust and fumes, but with the increasing value of crude potash salts, due to the war, the possibility and practicability of utilising this large amount of cement dust were soon recognised.

The dust collected from cement kiln gases consists of partly calcined raw material and ash from the fuel which have been mechanically carried over by the draught, and also of volatilised alkali compounds; the latter are principally in the form of sulphates. They contain, as a rule, about 10 or 11 per cent. of potash; of this approximately 86 per cent. is water soluble, so the dust with the present average value of \$3.50 per unit of soluble potash per ton, is worth about \$27.00 per ton. The soluble potash present usually occurs as sulphate, due to a combination of this base with the sulphur of the fuel, and where there is a deficiency of sulphur, it occurs as carbonate.

The rest consists of so-called insoluble potash; this is however "not insoluble", that is to say, it is soluble in dilute hydrochloric acid, or after prolonged treatment with boiling water, and is probably of a siliceous nature, being largely formed by the union of potash vapour with incandescent gas particles. The solution of this potash is accelerated by the presence of lime. The slowly soluble potash compounds are also formed by

(1) See *R.*, July 1916, No. 736.

(2) See the correction made on p. 814 of No. 8 (August 1917) of the same journal.

teraction of potash salts in solution with silicious material, this recommendation being greatly accelerated by heat.

The action of moist soil promotes the availability of the slowly soluble potash. In view of the gradual and continued solution of the potash in moist kiln dust, it should be of particular value as a fertiliser.

Two series of facts, however, are worthy of notice :

- 1) Whether the fuel used is oil or coal. In the latter case, the amount of water-soluble potash is less.
- 2) The lighter fractions of the dust which contain the greater percentage of volatilised compounds are richest in soluble potash, they contain, for example, 28.96 per cent. of potash with the oil-fired kiln, and 20.60 per cent. with the coal-fired kiln.

6 - Studies on the Root Nodules of Non-Leguminous Plants in Japan. — SHIBATA, KEITA and TAHARA MASATO, in *The Botanical Magazine*, Vol. XXXI, No. 366, pp. 157-182, 16 fig. + 1 plate. Tokyo, June 1917.

AGRICULTURAL
BOTANY,
CHEMISTRY
AND
PHYSIOLOGY
OF PLANTS

The formation of root nodules in non-leguminous plants has excited much interest, for it appears that also these nodules are capable of assimilating free nitrogen. All the nodules in question have certain common external characters (of these the most noticeable is their dichotomous bifurcation), but the distinctive character of the species which bears them clearly seen in the anatomical structure of the nodules.

Many points are still a matter of controversy, especially the systematic position of the endophyte giving rise to these structures. In order to throw some light upon the subject, the writers undertook a comparative histological study of the principal types of root nodules occurring in non-leguminous plants, namely 1) *Coriaria*; 2) *Myrica*, *Gale* and *Casuarina*; 3) *Alnus* and *Elaeagnus*.

The results were as follows :

Type 1: *Coriaria*. — Abundant symbiotic tissue, clearly marked off from the cortical parenchyma; the endophyte is here a typical actinomycete; the colonies in the host-cells have continuous walls, with centripetal, club-shaped filaments arranged like a comb around the vacuole containing the cell sap.

Type 2: *Myrica*. — The endophyte, an actinomycete, takes up its position in a peripheral layer of the cortical parenchyma, this layer being from 1 to 3 cells thick. In the centre of each host-cell is found a large dense coiled mass of the endophyte with club-shaped filaments radiating in all directions.

Type 3: *Gale*. — The cells containing the endophyte are irregularly distributed throughout the cortical parenchyma. No definite radial arrangement of the filaments is noticeable. Conidia formed by segmentation. It is probable that the root nodules of *Casuarina* also belong to this group.

Type 4: *Alnus*, *Elaeagnus* and *Ceanothus*. — Symbiotic cells distributed throughout the cortical parenchyma. Formation of little pustules at the tip of the thick coiled masses of the endophytic filaments.

The root nodules of *Coriaria* are superior, therefore, to all the others regards their anatomical differentiation.

Their characteristic symbiotic tissue is, from the point of view of organisation, quite equivalent to the bacteroid tissue of the root nodules of leguminous plants.

The symbiotic endophytes of the root nodules studied by the writer have important morphological characters in common. They are also formed of thick coils of very delicate, much-ramified mycelial filaments which stain best with acid fuchsin, and often enclose granules staining with Gram's reagent; in other respects, they show no cytological differentiation. The writers consider as typical the endophytes of *Myrica* and *Cornus* in which the actinomycete characters are unmistakably manifested, the others can easily be included among the actinomycetes, according to the present definition of that group. Whether there may be any phylogenetic relationship between the groups of plants furnished with root nodules is still an open question, as far as the genus *Alnus*, the Myricaceae and the Casuarinaceae are concerned.

In the case of the Coriaceae, the data necessary to decide the matter are still wanting. The family of the Elaeagnaceae seems to have quite different connections. That the genus *Alnus* can assimilate free nitrogen seems very probable. As regards the other plants furnished with root nodules the question can only be settled by means of careful experimental work. The opinion often expressed by HILTNER and others, that the soil assimilation products of the symbionts of the Leguminosae and *Alnus* is the hostplant, needs direct proof. It is only possible to determine by aid of the microscope that the living substance of the endophyte is certainly digested and re-absorbed.

It is much to be hoped that further biochemical studies will succeed in explaining many important points connected with the material's symbiotic exchange.

997 - **The After-Ripening of Sugar-cane; Chemical Changes which take place after Cutting.** — BARNES, J. H. (Agricultural Chemist, Punjab Agricultural College, Lyallpur) in *The Agricultural Journal of India*, Vol. XII, Part II, pp. 209-215, Tables X and XI, April 1917.

The writer's researches aim at establishing the chemical changes which take place in the sugar-cane after cutting, under the climatic conditions of Northern India, and at determining the factors underlying local practices with regard to the treatment of cut cane.

The writer summarises his results as follows:

It is evident that there is a scientific foundation for the custom practised in the Gurdaspur district of storing cut cane before crushing, and it tends to further ripening.

From the data recorded in the paper it is clear that this is attended with danger of losing sugar if the storing is continued for too long a period.

The length of time for which cane can be stored without suffering loss of sugar, and during which an actual increase in the amount of sugar the juice will take place, will vary with the temperature of the air and the condition of the cane. This period will become shorter as the temperature rises. Excessive cold, on the other hand, including too great a change

perature, may also bring about losses in sucrose owing to suspended activity of the cell protoplasm and result in a loss of control of the ordinary fermentation changes normally taking place there.

The Java system of covering cut cane with damp trash is to keep the nest alive. By this treatment the cane will be maintained at a uniform temperature and being in a moist atmosphere will not lose water. For a limited time depending on the temperature and condition of the cane, there should be an increase rather than a decrease in the sucrose content of the cane. On the other hand, moist heat will only induce the growth of molds, fungi, and bacteria, all of which bring about decay and fermentation changes, but will, once the cell is dead, induce rapid decay in the cell contents by hydrolysis and oxidation.

The after-ripening of cane is a matter of some importance to the factory owner who may, at any time, be forced to store cut cane owing to a breakdown in the mill, and the chemical changes outlined above will probably be of interest to him as well as to the student of the chemistry of sugar.

6 - **Studies on Tobacco Seeds, in Java.** - JENSEN, HJ., in *Procestation voor Versterklandsche Lucht, Mededeeling No. XXVIII*, pp. 51-57 + 3 fig. Semarang, 1917.

The author summarises the results of his studies on tobacco seeds as follows:

- 1) The small quantity of reserve food contained in the tobacco seed makes it necessary for the young plant to provide early for itself; for this reason, the first few days following germination are the most critical for tobacco.
- 2) From 15 to 20 grm. of seed may be collected from each plant.
- 3) Seed-capsules smaller than 17.5 mm. are of no value.
- 4) By removing some of the seed-vessels from a plant, the number of the seeds is greatly diminished without improving their quality.
- 5) The leaves may be removed from a plant without danger as soon as the first seed-capsules begin to ripen.
- 6) The germinating capacity of seeds collected when they begin to mature is greater than that of half-ripe seeds.

This fact may be explained thus: The reserves of completely ripe tobacco seeds are composed of oils rendered assimilable by the ferments of the germ (lipase and others). At the beginning of maturation the oils are not yet formed, the reserve material is still directly assimilable by the embryo, and germination may take place. When the seed is about half-ripe the oils begin to form, but it is only when the seed is completely ripe that the ferments form in sufficient quantity. It follows that the germ of half-ripe seeds cannot assimilate nutriment and germination does not occur. On the other hand, in certain cases, the germinating capacity has been improved by drying half-ripe seeds; in other cases, drying unripe seeds (i. e. seeds collected at the beginning of ripening) or half-ripe seeds, has been detrimental.

For this reason preference should be given to seeds which are as ripe as possible.

7) The seeds may be sorted with a sieve or a blower; the second method gives the best results.

8) The seeds may be kept in tin boxes with lime without there being any danger of their germinating.

909—**Effect of Frost on Plants at Leonardslee, Horsham, Sussex, England.** — Loebe, E. G., in *The Gardeners' Chronicle*, Vol. LXII, No. 1598, p. 57. London, August, 1917.

Leonardslee is 270 feet above the sea, which is thirteen miles away. The soil varies considerably, generally, however, containing sand more or less mixed with clay. Geologically it is "Upper Tunbridge sand" and "Cuckfield clay".

The natural growth is heather, bracken and birch trees.

Frost began on November 16, 1916. There was frost every night during the following 94 days, except on nine occasions (85 frosts in 94 days) to February 17. In April there were snowstorms nearly every day until the 17th. The thermometer fell to 9°F. on the grass on February 10, 1917, and to 17°F. in the screen — 23° of frost. For some days during the winter there was a cutting, north-east wind, and it is thought that most of the damage to the plants was caused by the wind, and not so much by the cold.

KILLED.

<i>Clanthus puniceus</i> (*)	<i>Escallonia argentea</i>	<i>P. pseudostrobus</i>
<i>Pistacia atlantica</i> (*)	<i>Eucalyptus amygdalina</i>	<i>P. Bonapartei</i> (?)
<i>Podocarpus ferruginea</i>	<i>E. Beauchampiana</i>	<i>P. Montezumae</i> (type)
<i>P. latifolia</i>	<i>E. cordata</i>	<i>Phyllocladus trichomanes</i>
<i>Gordonia obliqua</i>	<i>Callitris robusta</i> (*)	<i>Arctostaphylos stanisiana</i>
<i>Olearia semidentata</i> (?)	<i>Lindera glauca</i>	<i>Rhododendron bulbatum</i>
<i>Zanthoxylum acanthopodium</i>	<i>Pinus longifolia</i>	<i>R. Fordii</i> (?)
<i>Heteromeles arbutifolia</i>	<i>P. canariensis</i>	

* On a wall, — (?) Also in another list.

SEVERELY INJURED OR CUT TO THE GROUND.

<i>Eucalyptus Globulus</i>	<i>Cupressus lusitanica</i> var.	<i>Lindera macrophylla</i>
<i>E. acervula</i> (?)	<i>Benthamii</i> (?)	<i>Euonymus alatus</i> ?
<i>E. Muelleri</i> (?)	<i>Juniperus pachyphloea</i>	<i>Pistacia lentiscus</i>
<i>E. viminalis</i>	<i>Widdringtonia Whyte</i> (*)	<i>Carpenteria californica</i>
<i>Clethra arborea</i>	<i>Podocarpus acutifolia</i>	<i>Escallonia macrantha</i>
<i>Ulex europaeus</i>	<i>P. dactyloides</i>	<i>Olearia argophylla</i> *
<i>Calluna vulgaris</i>	<i>P. macrophylla</i> (?)	<i>Vaccinium Myrsinites</i>
<i>Pinus halepensis</i>	<i>Raphitamnus cyanocarpus</i>	<i>Banksia paludosa</i> *
<i>P. patula</i>	<i>Coprosma lucida</i>	<i>Cassinia leptophylla</i> *
<i>P. Greggii</i> (?)	<i>Aristotelia tomentosa</i>	<i>Pentapterygium carpinifolium</i>
<i>P. Bonapartei</i> (?)	<i>Azara crassifolia</i>	<i>Bumelia lycioides</i>

(1) *Pinus Bonapartei* is considered identical with *P. Ayacahuite* by some botanists; latter, however, is a much harder plant and not a leaf has been browned.

(2) The *Index Kewensis* considers this species identical with *Eucalyptus Surobi* — *E. macrohyncha* — *E. piperita*.

(3) The *Index Kewensis* considers this species identical with *E. incrassata*.

<i>a anomala</i> (*)	<i>Arctostaphylos Uva-ursi</i> var.	<i>D. aromatica</i> (*)
<i>anax serot</i>	<i>californica</i>	<i>Berberis congestiflora</i> var. <i>ha-</i>
<i>neon rigidum</i> (*)	<i>A. media</i>	<i>keoides</i>
<i>Scleriana</i> (*)	<i>A. manzanita</i>	<i>B. Fortunei</i>
<i>Beldus</i>	<i>Ostomeles anthyllidifolia</i>	<i>Fagus (Nedhojagus) Cunning-</i>
<i>cruciatula</i>	<i>Myrtus Luma</i>	<i>hami</i> (*)
<i>cyber</i>	<i>Camellia Thea</i>	<i>F. Solandri</i>
<i>stiflora</i>	<i>Olea europaea</i> (*)	<i>F. Menziesii</i>
<i>a (aquatica)</i>	<i>Tricuspidaria lanceolata</i>	<i>Rhododendron linearifolium</i>
<i>ia siligua</i>	<i>T. dependens</i>	<i>Embothrium coccineum</i> (*)
<i>a coccinia</i>	<i>Drymis Winteri</i>	<i>Lathospermum prostratum</i> (*)

in a wall — (*) Also in another list.

VERY SLIGHTLY INJURED OR LEAVES BROWNED.

<i>lophis corallina</i>	<i>C. Junebris</i> (*)	<i>Crevilia juniperina</i>
<i>chrysomela</i>	<i>C. cushmaniana</i>	<i>C. rosmarinifolia</i>
<i>salensis</i>	<i>C. lustranea</i> var. <i>Benthami</i>	<i>Pittosporum tenuissimum</i> (30
<i>camphora</i> (*)	<i>C. torulosa</i> (*)	feet)
<i>a excelsa</i>	<i>Podocarpus macrophylla</i> (*)	<i>P. patulum</i> (*)
<i>conum Lauretini</i> (*)	<i>Juniperus procera</i> (*)	<i>P. rigidum</i> (*)
<i>macrophylla</i>	<i>Myrtus communis</i>	<i>P. Ralphei</i>
<i>a purpurata</i>	<i>Callistemon lanceatis</i>	<i>P. pauciflorum</i>
<i>a (Abeliana)</i> (*)	<i>C. stiligium</i>	<i>Fagus (Nedhojagus) Cunning-</i>
<i>mona</i> (*)	<i>C. coccineum</i>	<i>ghami</i> (*)
<i>quercina</i> (*)	<i>Leucadocia Davisiae</i>	<i>F. fusca</i>
<i>quercus</i>	<i>Rhododendron Delavayi</i>	<i>F. cliffortioides</i>
<i>alba</i>	<i>R. arboreum</i> var. <i>Kermesinum</i>	<i>Arbutus Unedo</i>
<i>la Delavayi</i> (*)	<i>R. indicum</i>	<i>Abelia toribundia</i> (*)
<i>a repandum</i>	<i>R. macronulatum</i> (2)	<i>Euphorbia menziesii</i> (*)
<i>maul tonica</i>	<i>R. "ornubia"</i>	<i>Chosoya ternata</i> (*)
<i>agrostallatus</i>	<i>R. Keyseri</i>	<i>Distomatia spinosa</i> (*)
<i>quercus</i>	<i>R. spinosissimum</i>	<i>Lathospermum prostratum</i> (*)
<i>maul capitata</i>	<i>Quercus alnifolia</i>	<i>Epheura alissima</i> (*)
<i>Nelsoni</i>	<i>Q. chrysocarpus</i>	<i>Cupressus macrocarpa</i> (*)
<i>quercus</i>	<i>Q. agrifolia</i>	<i>Sophora tetraflora</i> var. <i>micro-</i>
<i>alba</i>	<i>Podocarpus vera</i> (*)	<i>phylla</i>
<i>maul (1)</i>	<i>Chamaecyparis humilis</i>	<i>Conocladus cuneatum</i>
<i>glauca</i>	<i>Photinia serrulata</i>	<i>Berberis nepalensis</i>
<i>quercus</i>	<i>Embothrium coccineum</i> (1)	<i>Arbutus tunicata</i>
<i>maul</i>	<i>Lomatia ferruginea</i>	<i>Anopterus glandulosus</i>
<i>nepalica</i> (*)	<i>Eucrophia cordifolia</i>	
<i>maul formosensis</i>	<i>Ericodendron japonica</i>	

in a wall. — (*) Also in another list.

PLANTS UNINJURED.

<i>maul (1)</i> (*)	<i>Nolina crumpeus</i>	<i>Spartanxys subigenus</i> (*)
<i>glauca</i>	<i>Dasylium serratifolium</i>	<i>Padus racifolia</i> (*)
<i>nepalensis</i>	<i>Erica australis</i>	<i>Fuchsia exorticata</i> (*)
<i>maul</i>	<i>E. lustranea</i>	<i>Fuchsia horrida</i>
<i>a Whipplei</i>	<i>E. arborea</i> (*)	<i>Vaccinium Martiana</i>
<i>a Parryi</i>	<i>E. mediterranea</i> (*)	<i>Bryanthus Breweri</i>

(1) Considered by the *Index Kewensis* as identical with *Pyrus pyramica*.

(2) Considered by the *Index Kewensis* as identical with *Rhododendron dauricum*.

<i>Helianthemum rosmarinifolium</i> (1)	<i>P. Montezumae</i> var. <i>Hartwegii</i>	<i>J. cedrus</i>
<i>Rhododendron Fordii</i> (2)	<i>P. Bonapartei</i> (2)	<i>J. procera</i> (2)
<i>R. triflorum</i>	<i>Pieris formosa</i>	<i>J. californica</i>
<i>R. Hookeri</i>	<i>Plagianthus Lyallii</i>	<i>J. phoenicia</i>
<i>R. cephalanthum</i>	<i>P. betulinus</i>	<i>J. thurifera</i> var. <i>pallica</i>
<i>R. nereifolium</i>	<i>Kniphofia Northii</i>	<i>J. bermudiana</i>
<i>R. Maddenii</i>	<i>Abies Webbiana</i>	<i>J. Wallichiana</i>
<i>R. Auchlandii</i> (type)	<i>A. Pindrow</i>	<i>Cupressus torulosa</i> (2)
<i>Desfontainia spinosa</i>	<i>A. Pindrow</i> var. <i>brevifolia</i>	<i>C. funebis</i> (2)
<i>Lapageria rosea</i> (*)	<i>Pseudo-larix japonica</i>	<i>Tecoma grandiflora</i> (2)
<i>Philesia magellanica</i>	<i>Larix Griffithii</i>	<i>Sarcocolla cuneata</i>
<i>Gunnera monoica</i>	<i>Libocedrus chilensis</i>	<i>Mandevilla scharlach</i>
<i>Smilax laurifolia</i>	<i>L. Dragona</i>	<i>Chisya ternata</i> (2)
<i>Ribes laurifolium</i>	<i>Fitzroya patagonica</i>	<i>Desfontainia spinosa</i>
<i>Clematis afoliata</i>	<i>Dacrydium Frankii</i>	<i>Criselinia littoralis</i>
<i>Magnolia Campbellii</i> (120 flowers)	<i>Saxifraga conspicua</i>	<i>Illicium religiosum</i>
<i>Elaeagnus umbellata</i>	<i>Glyptostrobus heterophyllus</i>	<i>I. anisatum</i>
<i>E. multiflora</i>	<i>Pittosporum Tobira</i> (*)	<i>I. iliridatum</i>
<i>Eunymus imbratus</i> (2)	<i>Cupressus glabra</i>	<i>Berchemia racemosa</i>
<i>Berberis japonica</i> (Bull.)	<i>Camellia reticulata</i> (*)	<i>Staudtia serrata</i>
<i>B. aggregata</i>	<i>Acacia Baileyana</i> (*)	<i>Drimys ciliata</i> (2)
<i>B. verruculosa</i>	<i>Atrocarpus cupressoides</i>	<i>Diospyros Kaki</i>
<i>B. dictyophylla</i>	<i>A. laxifolia</i>	<i>Osmanthus armatus</i>
<i>Pinus brutia</i> (2)	<i>A. schlegeloides</i>	<i>Parsonia heterophylla</i>
<i>P. mitis</i>	<i>Podocarpus alpinus</i>	<i>Quercus Walsbyana</i>
<i>P. cembroides</i>	<i>P. nivalis</i>	<i>Q. thalassica</i>
<i>P. edulis</i>	<i>P. nubigena</i>	<i>Q. cuneata</i>
<i>P. Parryana</i>	<i>P. Tolara</i>	<i>Q. vibrayana</i>
<i>P. monophylla</i>	<i>P. macrophylla</i> (2)	<i>Q. imbricata</i>
<i>P. hungana</i>	<i>Keteleeria Davidiana</i>	<i>Beschorneria viscag.</i>
<i>P. Gerardiana</i>	<i>Phyllocladus trichomanoides</i> (2)	<i>Olea europaea</i> (2)
<i>P. albicaulis</i>	<i>Tsuga Brunoniata</i>	<i>Pinus insignis</i>
<i>P. Ayacahuite</i>	<i>Romneya Coulteri</i>	<i>Styrax Feltcheana</i>
<i>P. palustris</i>	<i>R. trichocalyx</i>	<i>Caraya tomentosa</i>
<i>P. Montezumae</i> var. <i>rudis</i>	<i>Viburnum Carlesii</i>	<i>Cupressus macrocarpa</i>
	<i>V. rhytidophyllum</i>	<i>Olearia semidominica</i>
	<i>J. niperus oxycedrus</i>	

* On a wall. — (2) Also in another list.

910 - **Flowering of Fruit Trees Influenced by Frost, in the United States.** — See X of this Review.

911 - **A New Physiological Theory of Heredity.** — RABAUD, ETIENNE, in *Congress of the Sciences de la Société de Biologie*, Vol. LXXX, No. 15, pp. 738-744. Paris, July 21.

The two chief theories held today on the phenomena of heredity that of BATESON and that of MORGAN — are both based on the concept of "factors", units independent of each other and also, it would appear of the living substance itself. These "factors" are purely imaginary they may, therefore, be multiplied to infinity, and the most incongruous and unlikely properties may be assigned to them. Having once admitted the existence of these factors, the central idea of both theories is *segregation*, their division in definite proportions amongst the descend-

(1) Considered by the *Index Kewensis* identical with: *H. lavandulaefolium*; *H. noidis*; *H. variabile*; *H. Lippii*; *H. canadense*. (2)

re hybrids. The questions of dominance or non-dominance take a secondary place, and the explanations given by BATESON and MORGAN rest only on very improbable hypotheses.

The author addresses the following reproaches to theorists: 1) they have not examined in any way the processes produced in the first generation (F_1); 2) they have only studied dominance, or its intermediate stage, far as the following process leads to segregation; 3) they have considered the question as if the second generation controlled the first, whereas it is obviously the contrary which occurs; 4) fascinated as they are by segregation they have failed to conceive any uniform function of the organism, whereas the organism is a whole.

Living substance is a complex mixture of colloidal proteins and electrolytes, forming a heterogenous whole of *plastic substances*. These substances are dependent one on the other, their external exchanges are effected with a constant interaction, and the properties of each of them are determined by the very nature of this interaction. The organism is a whole, and it is only by this conception that one explanation can be given of all the various factors of heredity.

Heredity is not a vague "factor" giving rise to the theory of an immaterial "power" governing the organism from without; it is simply the continuity and resemblance of particles of living matter derived one from the other. The asexual generation shows this in all its simplicity; the sexual generation gives it a more complex appearance, but it remains none the less essentially a *fact of double continuity and double resemblance* when the gametes which unite undergo no modification (in the opposite case there is continuity without resemblance; there is no heredity).

From the point of view of peculiarities emphasised by others or to be transforming peculiarities which, new in appearance, transmit a double resemblance, experiments in heterogenous fertilisation show the deleterious local actions of the sarcodes of different species. These experiments also establish the existence of a continuity to exist through all the degrees, from the total destruction of a simple physiological inactivity of one of the two united gametes, to the complete isolation of parts of these two gametes; that there is, at times, in this respect, a marked difference between the two sexes, and, finally, that the external conditions modify sensibly the interaction of the sarcodes. According to author all fertilisation due to the union of two gametes from distinct animals is a heterogenous fertilisation.

Modern geneticists admit that a special affinity unites two determined parts of the sarcodes, and that these parts act independently of the others; this hypothesis seems contrary to actual fact. The author, on the other hand, holds that, in the absence of precise data, it is best to state simply that certain parts of one of the gametes do not find conditions favourable for their development in the complex which results from the union of the gametes.

With regard to the interchangeability of different racial characters in hybrids of the second generation which may present a mixture of these characters, the author does not admit the theory of autonomous, inter-

changeable "factors". He regards these factors simply as another way of designating chemical bodies; since each property of a chemical body asserts itself under definite conditions, the effects of these properties vary with the changes which these conditions undergo. All, then, is a function of the whole. When the gametes form in the hybrids of the first generation, a redistribution of the plastic substances is brought about and there result new complexes which differ little from the original sarcode (because this is composed of a certain number of the parts which constituted it previously). The various plastic substances occur in conditions fairly similar to their customary ones because the greatest change they can undergo is a modification of their exchange activity. It follows that, if the new complexes favour the physiological activity of these substances, they produce the effect which they would have produced in the pure gametes, or at least, a very similar effect; but this effect is only the result of a given complex.

Mendelians do not admit the existence of intermediary forms, but affirm that segregation always occurs, though it is more or less marked accordance with the number of "factors" participating in it, and which are all similar. Nothing, however, implies the impossibility of the formation of true intermediaries. Exact complete and intermediate dominance are in no way opposed to each other, they are only the extreme degrees of the heterogeneity of the gametes, quite compatible with persistence of the parts which constitute them.

For some Mendelians, the "combinations" produced in the distribution of the characters of the ascendants in the descendants are actual evolutionary variations, produced solely by hybridisation. According to this author this conception is incorrect, and the different arrangements to which the crossings give rise have no connection with any variation properly speaking. If, at times, from one generation to another, modifications are produced, they are attributable solely to the fact that plastic substances, like all other chemical bodies, are subject to transformation; such transformation occurs especially during the course of their interactions, and may be either lasting or momentary. External influences play an important part. Variation leaves continuity intact, but interrupts resemblance.

In many cases the data gained by experience and observation give very exact results, but they are preferable to the attitude of imprecise precision found in modern works, a precision which is wholly artificial and highly dangerous, and which gives the illusion of the permanent when essentially, only the temporary exists.

912 - **The Determination of the Seeds of Cultivated Plants.** — FRANÇOIS, LOUIS, in *Annuaire de la Science agronomique*; I, Year 32, No. 1-6, pp. 30-55, 30 figs. Paris, January-June, 1915. — II, Year 33, No. 1-6, pp. 207-295, 110 figs. Paris, January-June, 1916.

Hitherto no author has collected the seeds of plants in view of the rapid determination with the aid of tables similar to those drawn up by the author. The author has undertaken this work. For the present he has restricted himself to the determination of the seeds of a certain number

of cultivated plants; later he intends to publish a similar work on the seeds of the most common wild plants.

I. — In the first part seeds are discussed generally, and those of the Leguminosae, Gramineae, Cruciferae, Umbelliferae, and Compositae, the most important families on account of the large number of cultivated species they include, are reviewed successively. These general remarks are illustrated by 30 figures.

II. — The second part is devoted to tables of the characters of the seeds of cultivated plants. These tables allow of their rapid determination, which is still more facilitated by 110 figures, drawn from nature.

3 - Grass and Clover Seed Imports into the United States — *Commerce Reports*, No. 107, pp. 198. Washington, D. C., May 8, 1917.

The following table, prepared in the seed laboratory of the United States department of Agriculture, shows the amount of the various kinds of seeds subject to the seed importation act permitted entry into the United States during the fiscal year ending June 30, 1916, as compared with the nine months ending April 30, 1917:

Kind of seed	July 1, 1915 to June 30, 1916	July 1, 1916 to April 30, 1917
	Pounds	
<i>Allalfa</i>	3,284,796	2,882,337
Awless brome grass	313	1,442
Blue grass:		
Canada	668,300	417,093
Kentucky	1,200	
Clover:		
Albino	1,113,404	4,278,000
Crimson	4,303,623	5,004,027
Red	32,507,530	5,300,404
White	148,768	120,464
Millet:		
Hungarian or German	117,780	287,727
Brown corn	1,104,580	301,740
Mixtures	33,297	442,090
Oat and grass	784,470	1,280,342
Rape	4,018,008	2,014,036
Rye grass: (a)		
English	4,510,440	1,513,055
Italian	382,841	330,333
Limby	118,737	1,507
Vetch: (b)		
Haire	67,683	223,800
Spring	61,643	24,800

(a) Subject to the Seed Importation Act since November 1, 1916.

914 — **The Cultivation of Wheat by Hoeing.** — RAY, EARL, in *Journal d'Agriculture pratique*, Year 81, New Series, Vol. 30, No. 18, Paris, September 6, 1917.

The three arguments against the cultivation of wheat by hoeing are:
 1) the difficulty, in many cases, of drilling in lines; it should, however, be easy to construct simple and strong drills at a moderate price, which could be used in practically all soils;

2) shortage of labour; this difficulty could be overcome as in cultivation of other crops by hoeing;

3) the fear of smaller yields owing to the lines being of necessity wider apart.

It was for the purpose of clearing up this last point that the cultivation experiments described in the present paper were undertaken. The results obtained in 1916 with Bordeaux wheat are first discussed.

In order to be able to use horse-drawn machines, a width of 24 in. was given to the spaces down which the animal was to pass, and the spaces were separated by double lines of wheat 8 ins. apart. Each line thus had half of the large space, 12 ins., plus half of the small space, 4 ins., a total of 16 ins., that is to say, there were two and a half lines to every metre.

Four lines were sown with the following quantities of wheat:

1st. line. — 40 seeds to the metre per line, or 1 seed every 25 mm.

2nd. line. — 40 seeds to the metre, but placed 2 and 2 in holes 0.05 m. apart.

3rd. line. — 20 seeds to the metre, 2 seeds in each hole, 0.10 m. apart.

4th. line. — 13 to 14 seeds to the metre, 2 seeds in each hole 0.15 m. apart.

The yields of the different lines only varied very slightly; that of the 25 mm. line was just a little greater than the others. Preference should, therefore, be given to close sowing.

In 1916 a yield of 71.37 bushels per acre was obtained from wheat cultivated by hoeing and sown as described above on the 9th. November, 1915.

The experiment was repeated this year with the same Bordeaux wheat sown and cultivated by the same methods. There were two sowings, one on the 28th. September, 1916, and the other on the 3rd. November, 1916.

The first sowing gave a yield 90.7 bushels. This increase is doubtless due to the early sowing, though this has not been confirmed because, at the time the paper was written, the second crop had not been harvested.

The experiments prove that widening the spaces between the lines in the cultivation of wheat by hoeing, far from causing a decrease in yield, causes a considerable increase owing to the beneficial effect of the hoeing and tillage.

915 — **The Comparative Study of Various Wheats in the United States.** — See No. 913 in this Review.

Grass Land and Ploughed Land (1). — STAPLEDON, R. G. (*Adviser in Agricultural Science, University College of Wales, Aberystwyth*), in *Supplement to the Journal of the Board of Agriculture*, No. 17, 39 pp. London, May, 1917.

In considering the position of grasslands in relation to the necessity increased home-grown food in England, the writer insists upon the adoption of a broad point of view. Plans of improvement should aim at obtaining the maximum amount of keep from fields under grass. The possible methods to be employed must therefore not only include drainage, top dressings, or re-seeding, but if necessary, also the adoption of considerably varied rotations.

Grass-land in England is classified as follows :

1. **PERMANENT GRASS.** — Includes fields that have been down for over 20 years.
2. **OUTRUN GRASS.** — Falls under two distinct heads :
 - a. *Sowle leys*, i. e. leys that have either tumbled down without sowing from a corn-field, or owe their origin to an outrun sainfoin breadth or an inadequate original seeding.
 - b. *Outrun permanent grass*, or grass that has been allowed to deteriorate gradually through mismanagement.
3. **LEYS.** Are either :
 - a. rotation, or
 - b. temporary meadows or pastures.

The problem for the grass farmer consists of three parts :

- 1) How, with the labour and machinery and implements at his disposal, to extend his rotation land to stand in a reasonable and economic position to his area under permanent grass ;
- 2) How to improve his remaining grass ; and
- 3) How to establish high class temporary leys.

Dealing first with methods of improvement which do not involve turning the existing turf and re-seeding or altering the rotations, the means which may be usefully employed are 1) top dressing, 2) renovating mixtures, 3) altered methods of stocking, 4) substituting pasture for meadow rotations or the reverse, 5) eradication of weeds, and 6) drainage.

1) **TOP DRESSINGS.** — The permanent improvement of pastures by dressings depends chiefly upon the action of suitable treatments on leguminous herbs. In recent years the most remarkable results have been obtained with basic slag ; both it and lime have been shown to exert a profound influence on the spread of white clover and other plants.

2) **RENOVATING MIXTURES.** — A renovating mixture is probably justified on fields where top dressings are unable to establish a development of leguminous herbs. The seeds to be sown should consist chiefly of old white clover (*Trifolium repens*), bird's foot trefoil (*Lotus corniculatus*) and yellow snuckling clover (*Trifolium dubium*) with a little of such permanent grasses as crested dog's tail (*Cynosurus cristatus*) and rough-leaved meadow grass (*Poa trivialis*) ; perennial rye-grass (*Lolium perenne*) may be added to act as " nurse " and offer some protection to the smaller things when stock are first turned in. Renovating should be followed with liberal dressings of phosphatic manures. Harrowing may sometimes be necessary to help seeds to obtain a hold.

[1] See also R. 1916, No. 1277.

(Ed.)

3) **ALTERED METHODS OF STOCKING.** — Prolonged grazing with a class of animal only usually leads to deterioration in the herbage. It cannot be too strongly emphasized that grass-land left unmanured and practically ungrazed deteriorates much more rapidly than land over-stocked. The essential point for the grazier to work upon is that proper stocking encourages the valuable indigenous pasture grasses as nothing else will.

4) **SUBSTITUTING PASTURE FOR MEADOW CONDITIONS, OR THE REVERSE.** — Poor meadows can often be improved by a period of grazing (3 years). The fields should be liberally dressed with basic slag and subsequently with farmyard manure during the period of grazing. Vice versa, poor pastures can be improved by taking one or two crops of hay. A poor pasture consists largely of bent (*Agrostis*), which seeds late. If the hay cut in good time a preponderant amount of seed will fall from s. rye-grass, crested dog's tail and wild clovers as may be present, to ultimate advantage of the field.

The field should not be manured for the benefit of the hay unless meadow conditions are to be maintained for a considerable period. Liberal manurial treatment would best follow when the field was again used as pasture. A change from pasture to meadow conditions continued for a period of years tends to suppress such weeds as thistles and soft grass and frequently also reduces moss.

5) **ERADICATION OF WEEDS.** — The writer gives brief notes on the eradication of some of the worst weeds of grass-land.

6) **DRAINAGE.** — There are large tracts of poor grass-land on retentive clays that could be improved comparatively cheaply by mole drainage. The effect of mole draining on such pastures is not only to carry away excess water, but also to aerate the soil and therefore to encourage an earlier and prolonged growth of grass.

We now come to the alternative method of improvement, namely breaking the turf. The writer summarises his conclusions on this part of the paper as follows:

The improvement of grass-land may often be better achieved by adoption of altered methods of farming than by resort to top dressings and other surface treatments only.

Well conceived plans to extend the acreage under crops in grass tracts of high average rainfall should not seek to add only to the arable area, but should also be directed to a regular sequence of highly-productive temporary leys. Indiscriminate extension of the arable area in such tracts can only, as in the past, make for subsequent infertility.

It has been shown that it is possible to do much of the ploughing necessary to convert poor grass into rotation land with productive leys. The additional object of improving permanent grass as such, both during late spring and summer and in adverse weather during winter.

There is, in consequence, in many districts considerable scope for employment of motor tractors over a greatly extended period of the year apart from the preparation of land for the sowing of autumn wheat.

The selection of suitable mixtures is of the utmost importance in

tion with farming on the temporary ley basis. At one end of the scale is necessary that the rye-grass clover mixtures should be reinforced, and at the other end, there is considerable scope for simplification in the complicated mixtures often employed.

2. - Action of Artificial Manures on a Mountain Meadow in Switzerland — DESSEYRE, C., in *Annuaire Agricole de la Suisse*, Year XVIII, Part 1, pp. 7-9. Berne, 1917.

Results of an experiment, lasting from 1914 to 1916, on a pasture situated in the neighbourhood of Riddes (Valais, Switzerland) at an altitude 1500 metres, with soil formed of schists and gravels poor in lime.

The following manures per hectare (1) were applied at the end of the turn of 1913:

Phosphatic manure 1000 kg basic slag costing 8 francs per 100 kg.
 Potassic 400 kg. of 30 % potassic salts, costing 14 francs per 100 kg.
 Nitrogenous 200 kg of sulphate of ammonia, costing 12 francs per 100 kg.
 this manuring was repeated in April 1915).

The following are the results of the 3 years' experiment:

Manure	Dry fodder — quintals	Surplus crop		Cost of manuring — francs	Profit	
		Weight — quintals	Value — francs		— francs	per cent
None	77.0	—	—	—	—	—
+ slag	98.2	21.2	164.60	80	84.60	112.1%
+ slag + potash salts	127.3	50.3	402.40	136	266.40	146
+ slag + potash salts + sulphate of ammonia	157.8	80.3	642.40	204	338.40	144

The botanical composition of the turf for 1916 was as follows:

	Gramineae	Leguminosae	Other plants
Without manure	48 %	16 %	36 %
Phosphatic	37	30	33
Phospho-potassic	36	37	27
Phospho-nitropotassic	45	30	16

The proportion of red clover increased in proportion as the other plants decreased, the majority of which latter, geranium and yellow rattle, gave poor forage. The nitrogenous manure favoured the good grasses, the phosphatic and potassic manures favoured particularly the growth of clover and other Leguminosae.

(1) 1 kilo per hectare = 0.562 lbs per acre

918 - **Cotton-Growing in the New Hebrides.** — CORLETTE, EWAN, in *The Agricultural Gazette of New South Wales*, Vol. XXVIII, Part. 6, pp. 438-439, Sydney, June 1917.

In the New Hebrides, the cotton plant grows to a considerable size though all varieties do equally well, the best return, taking everything into consideration, comes from the Caledonian Dwarf, and for these reasons:

It is exceptionally hardy, of compact habit, and does not deteriorate to any great extent during successive seasons; it is an immense cropper, and the bolls remain on the plant long after they are ripe and are not injured quickly by rain; being of the kidney variety it is very easily picked.

In the New Hebrides, the rainy season begins in December; planting is then started, being continued till the end of February. The plants are put into the ground from 8 to 12 ft. apart in squares, according to the variety; thus Sea Island is planted 8 ft. \times 8 ft.; Caledonian Dwarf 9 ft. \times 9 ft.; and Caravonica 12 ft. \times 12 ft. As a rule, one bunch of kidneys is sown in each hole, and the ground is hoed until the seedlings have attained a good size when their own shade prevents weeds from growing. At this time, the most vigorous seedling is left in each hole, the rest being thinned out.

The following directions should be carried out, especially in the case of the Caledonian Dwarf variety.

The ground need not be cultivated, or even stumped — just burnt clean and thoroughly weeded — the seed is hoed in like maize and sown one inch deep; it is best to put only one kidney in each hole. Picking starts 8 to 10 months after sowing; there are usually 2 crops in the season. One man can keep 4 acres picked clean, going over the plants about every 10 days. On active intelligent man, or woman, can easily pick 60 lbs. of cotton in the best day of 9 hours. In the United States of America, the average day's picking for one man amounts to much more. The average yield per acre is $1\frac{1}{2}$ ton. The second crop in the season is about half as large as the first.

About 13 months from planting, the plants are cut back to within about 3 ft. of the ground, preserving the natural rounded shape as much as possible. The next year, the young mature wood is cut to within 6 inches from where it joins the wood of the previous season. The long shoot should be pinched back to promote a bushy shape and prevent the cotton getting out of reach. Plants remain profitable for about 4 years.

The best crops are grown on soils of medium quality; rich soil does not do too much leaf and wood.

Samples of Caledonian Dwarf cotton from the New Hebrides have been valued in England at 1s. 2 d. per lb., while Sea Island cotton from the same place was valued at 2s. per lb. The local price of the former variety is about £ 20 per ton.

919 - **Paka Fibre (*Urena lobata*) or Madagascar Jute.** — Investigation carried out by the Jardin Colonial, and published in the *Revue agricole et vétérinaire de Madagascar et ses Dépendances*, No. 9, pp. 36-37, Tananarive, July 1917.

Samples of Madagascar textiles were sent by the Ivoloana State to the JARDIN COLONIAL at Nogent-sur-Marne (France) with a request for information as to their commercial value. Among these samples was one of Paka fibre, as yet little known in commerce.

The investigation gave the following results:

In appearance and quality Paka resembles *Corchorus* fibre, but its filaments are often markedly shorter than those of the true Indian jute. It might be possible to remedy this to a certain extent by close sowing and a careful choice of the soil in which the crop is to be grown. The fibres might be classed according to their shade, which varies from white to reddish.

The sample was of good average strength.

The opinions of manufacturers who examined the fibre were very various. Those who habitually use Indian jute were opposed to the use of *Urena lobata*, and affirmed that this fibre, like all other similar textiles derived from the Malvaceae family, is only suited for use in native factories where labour is cheap. Other manufacturers realised that Paka fibre closely resembles jute, except in the length of its stalks, which are shorter than those of the *Corchorus* family.

It seems that Madagascar *Urena lobata* may be used in a similar way to Calcutta jute in the preparation of packing sacks and cloths, and manufacturers seem inclined to buy it.

It appears that *Urena lobata* is used commercially in South America under the name of *Armina*, and is specially suited to the manufacture of packing sacks and cloths.

10. **Oil-Producing Plants of French West Africa.** — FRANÇOIS, G., in *Bulletin de l'Office Colonial*, Year 29, Nos. 113-114, pp. 223-261, Melun, May-June, 1917.

OIL-YIELDING
PLANTS

The products of oil-producing plants are by far the most important in West Africa, both in quantity and in value. Some are already being exported in increasing quantities, others have only recently been put on the market, whereas yet others will be put on the market before very long.

Those of the first category are, in order of importance: pea-nuts, palm nuts and oil, copra, shea butter, sesame, castor-oil. Then come the seeds of Pécun hemp (*Hibiscus cannabinus*), of kapok, cotton, *Dumoria*, "benéfing", "benéfing", horse-radish tree (*Moringa Pterygosperma*), physic-nut (*Jatropha Curcas*), "lamy" or "tama" (*Pentadema oleacea*), "kala" or toulou-couma (*Carapa Touloucouma* Guillemin and Perrottet, *Carapa guineensis* Don), African oak (*Lophira alata*), argemone; these are all secondary products which are not included in the statistics.

Pea-nuts. — Nearly all of these come from Senegal, but a small proportion also come from Upper Senegal and Guinea. Before long pea-nuts will also be exported from the Ivory Coast.

The average yield for Senegal has been estimated at 8 cwt. per acre; good soils it is almost 16 cwt. per acre; 1 bushel of pods weighs 24 lbs.; the decorticated seeds represent, on the average, 75 % of the weight of the whole fruit. They are exported in the shell, but it would be well to decorticate them on the spot.

The different varieties of pea-nut are:

1. French West Africa: North of Rufisque (extra Cayor, Rufisque, superfine Rufisque).

2. French West Africa: South of Rufisque.

3) French West Africa: Soudan, Gambia, Guinea.

4) India and Coromandel.

The best quality ones are those from Senegal; the Cayor and Faticke varieties may give as much as 32 % of oil, and 45.82 % if they are decorticated.

The results of analyses carried out by M. AMMANN (Professor of the High School of Colonial Agriculture of France) are given. These show clearly the high value of French West African pea-nuts, as well as that of the straw, bran and cakes in the feeding of animals.

Attention is drawn to the value of pea-nut cake as a foodstuff for cattle, and the latest work done on this subject (1), and to the fact that M. AMMANN's experiments have shown that pea-nut flour may be used for human nutrition in bread and biscuits without leaving an unpleasant taste of any kind.

The means of protecting the nuts against natural enemies (particularly white ants), against drought, etc., together with the improvements to be carried out, are given.

In Senegal, the trade in pea-nuts rose from 27 221 tons, of a value of £207 271, in 1890, to 305 067 tons of a value of £2 286 837 in 1915. In the Niger Upper Senegal in 1913, the figures were 8 577 tons of a value of £99 295. In French Guinea the trade increased from 560 tons in 1909 to 1266 tons in 1915.

Oil Palm (Elaeis guineensis). — Palm oil is next in importance to pea-nuts and is the fundamental factor of the wealth of Dahomey. It would be well if good commercial methods of extraction were adopted on the spot.

M. AMMANN's analyses are given, together with the following figures for the exports in 1915:

	Palm oil Tons	Nuts Tons
Casamancy (Senegal)	—	1 724
Guinea	374	8 820
Ivory Coast	4 983	9 113
Dahomey	9 598	23 224

It would be advantageous to extract the oil from the palm nuts before exporting them, as the oil thus obtained is of better quality than that extracted from the nuts after they have been shipped.

Coconut. — This is cultivated for its products on the Ivory Coast and in Dahomey only.

Copra is being used more and more in oil and soap factories, as well as in the manufacture of vegetable butter, and thus has almost unlimited markets. The quotations for this product are increasing continually, and whereas at Marseilles, in 1913, it was quoted at £1.12.6 to £2.0.6, it varied from £4 to £5.4.0, in 1916.

(1) See R. May, 1-17, No. 463.

The results of M. Ammann's analyses of copra oil and cake are given. The following other important products are reviewed in a similar, but detailed, manner: — shea butter, sesame, Deccan hemp, kapok and m. Their production has not yet been greatly developed in French Africa, but it is continually increasing, and capable of becoming of importance.

Oil-producing plants are of great importance in the French West African export trade: in 1915 they amounted to £2 960 000 out of £4 760 000 in total exports; this represented 304 000 tons of pea-nuts, 15 000 tons of oil and 36 890 tons of palm-nuts.

Sugar Cane Cultivation and Sugar Manufacturing in Eastern Bolivia. — BLOOM FIELD, H. E. (British Vice-Consul at Santa Cruz), in *The Board of Trade Journal*, Vol. XXVII, No. 1063, pp. 86-87, London, 1917.

SUGAR CROPS

Sugar cane grows luxuriantly in eastern Bolivia, attaining a great height, and the crop is seldom injured by frost. The cultivation is conducted in the most primitive manner. The land is cleared and the undergrowth removed, the tree trunks that can not be made into firewood being left to rot on the ground. The planting is done by jabbing oblique holes with a long sharpened stake, about 3 feet apart, and inserting a piece of cane. The cane soon sprouts, after which the ground has to be cleared of weeds. The digging must be repeated until the cane is tall enough to smother the weeds. The ground is never ploughed or irrigated; cultivation consists simply of hoeing the weeds, which is all done by hand labour with a small native digging hoe. In about 10 months the cane is ripe and ready for cutting. Every three weeks after cutting the cane leaves are dry enough to burn, and fire is applied and the whole field burned off. The cane roots soon sprout again, and the same weeding operations have to be gone through in the previous year. This process is continued year after year until the field has to be replanted; this replanting is repeated three or four times, when the ground becomes exhausted, and the field is then abandoned and the planter changes to new ground.

Sugar is made by boiling the cane juice in a copper cauldron until it becomes of the proper consistency, when it is transferred to earthenware casks with a hole at the bottom for the molasses to drain from. The refining is done by the claying process. The molasses is made into alcohol, but planters still use the antiquated wooden sugar mills, and most of the mills in use are operated by animal power. Owing to the immense cost of transportation in eastern Bolivia, even a comparatively small steam engine requires considerable capital to buy, import, and install, besides having to wait at least a year from the date of ordering until it is set up and in working order. Another reason for using the old mills is that the native planter has no love for machinery, being in consequence, ignorant respecting it, and either can not or will not learn anything about a steam engine. There are only 15 steam-power sugar mills in all eastern Bolivia. The water-power mills are generally worked by means of oxen.

During the year 1914 Bolivia imported 8 500 tons of sugar, valued at £100 000 for consumption in the western Departments. Given under the

present disadvantages of transportation all this sugar could have been produced in the Department of Santa Cruz.

922 — **Sugar Cane and the Chemical Modifications it Undergoes after Cutting under Climatic Conditions of India.** — See No. 907 of this Review.

923 — **The Experimental Plantations of Vallombrosa, Italy.** — PREZZOLI, L. (Professor of Forestry and Technology at the Royal Institute of Forestry, Florence), *Gli Archivi Sperimentali di Vallombrosa*, 99 pp. Florence, 1917.

The experimental plantations of Vallombrosa are under the control of the Department of Forestry, Apiculture and Technology of the Royal Institute of Forestry of Florence. They are situated at a height of from 2 886 to 2 952 feet, cover an area of 21 acres, and are divided into 6 parts. The first part, started in 1869 by BÉRENGER, is chiefly used as a nursery for plants for replanting woods; the others, planted by PERONA, form the richest collection of trees in Italy. The average temperature of Vallombrosa varies from a minimum of -0.1°C to a maximum of 27.7° ; the annual precipitation is 1531.2 mm. during an average of 137 days. Observations carried out during 3 years in the field and in the pine wood bordering the plantation, showed the evaporation to be 548.96 for the field and 358 for the pine wood. The plantation has a clay or silicious sub-soil, and is formed largely by disintegrating sandstone.

A list of the various trees in order of their families and genera is given together with their maximum height, their circumference at 1 metre from the ground, and their age, as well as the countries in which they grow.

This list shows that the plantation includes trees belonging to 76 families, 244 genera and 1 337 species, among which are 39 *Pinus*, 17 *Pinus*, 23 *Abies*, 17 *Thuja*, 24 *Cupressus*, 26 *Juniperus*, 55 *Salix*, 20 *Quercus*, 39 *Pyrus*, 45 *Crataegus*, 35 *Prunus*, 36 *Acer*, 22 *Fraxinus*, and their varieties.

LIVE STOCK AND BREEDING

924 — **Contribution to the Study of "Tembleque" (1).** — RIVAS, HERACLES in *Anales de la Sociedad Rural Argentina*, Year LII, Vol. LII, No. 4, pp. 338, 1 fig. Buenos Aires, January.

About 5 years ago and again quite recently the writer observed several cases of "tembleque" in the neighbourhood of La Plata, among animals grazing on pasture where close examination showed no plants. *Paspalum dilatatum*. The graminaceous host of the fungus causing the disease in this particular case was *Sporobolus indicus* and the fungus *Neovossia Ravenelii* (B. C.) Speg. (both identified by SPEGAZZINI). The symptoms of the "tembleque" are very similar to those of the "tembladero" caused by *Festuca Hieronymi* infected by the fungus *Endocaulis tembladera* Rivas and Zanolli.

(1) See also R., September 1917, No. 829.

The Sheep Tick and its Eradication by Dipping. — IMES, M., in *United States Department of Agriculture, Farmers' Bulletin* 798, pp. 31, 15 figs. Washington, D. C., May, 1917.

The Sheep Melophagus (*Melophagus ovinus*), wrongly called sheep tick the United States, is a blood-sucking ectoparasite which infects sheep at both on farms and on fanges. This parasite is very common and eads rapidly, especially among sheep on over stocked pasture-land, ere it may cause very serious loss.

The biological cycle and habits of the insect, together with the methods identifying it, are described.

Dipping is the only practical method of destroying the parasite. Two dips are necessary with an interval of 24 days between them, because first dipping may not destroy all the pupae, which may subsequently ch a new brood. Various kinds of dips may be successfully used — soap alution, coal-tar-cresote, 0.07 % nicotine, soap and cresylic acid (0.50 %), e-sulphur-arsenic. The cost varies from 2 to 3 ½ cents per head for each ping. The lime-sulphur-arsenic dip was found the most satisfactory. s made by mixing standard strength lime-sulphur dip with ½ - standard ighth arsenical dip.

The lime sulphur dip contains 8 lbs. of unslaked lime (or 11 lbs. of co m-nd hydrated lime, not air-slaked), and 24 lbs. of flowers of sulphur (r plur flour, to every 100 galls. of water. The lime is put in a water-tight, flow-box, and sufficient water added to form a thin paste. The sulphur ided into this and the whole is well mixed till a paste, about the con-ency of mortar, is formed, adding water as required. The paste is led to 30 galls. of boiling water, and boiled for 1 hour, water being led from time to time to keep the volume constant.

If, after boiling, all the sulphur is not dissolved, small quantities of alkali may be added. The liquid is drawn off into a settling tank fitted h an outlet at least 4 inches from the bottom, in order that the liquid y be drawn off clear. It is essential that no sediment be left, as it will re the eyes and wool of the sheep. The clear liquid is drawn off into ats and every 30 galls. diluted with 70 galls. of warm water.

To every 500 galls. of lime-sulphur solution thus prepared and diluted, add 4 lbs. of arsenic and 12 lbs. of sal soda prepared as follows: 12 ls. of water are heated to boiling point and 12 lbs. of sal soda added, on this has dissolved 4 lbs. of powdered white arsenic are added, and the sure boiled and stirred for 15 minutes or longer, until the arsenic has uly disappeared. The arsenical solution is then added to the diluted e-sulphur solution in the vat. When the arsenical solution is added a low, flocculent precipitate is formed which remains in suspension. The id should be well stirred before the sheep are dipped. As this dip is sonous the necessary precautions must be taken in using it.

A full description of dipping baths is given, with the methods for dip- g both large and small flocks. Plans of baths made both in wood and cement are given. The appended figure shows the plan of a cement vat.

The Physiological Action of Symbionts.—PORTIER, PAUL, in *Comptes rendus des séances de l'Académie des Sciences*, Vol. 165, No. 7, pp. 267-269, Paris, August 13, 1917.

In a preceding paper read before the Académie des Sciences (1) the author gave the morphological and bacteriological characters of microorganisms which he had isolated from animal fat tissues.

The author considers these microorganisms to be symbiotic microorganisms, or symbionts, whose actions on the various elements of the animal reproduce those which occur within the tissues. Their physiological properties are:

1) remarkable synthetic actions; for example, the polymerisation of glycogen with formation of a polysaccharide resembling glycogen;

2) the utilisation of nitrates to form organic nitrogen (the same phenomenon occurs in the organism of mammals).

On the other hand, investigations started in 1912 show the symbionts capable of the following actions among others:

1) transformation of amino acids, liberation of ammonia, decarboxylation, oxidation (oxidation of glycerine to dioxy-acetone);

2) transformation of a neutral salt into an alkaline carbonate, thus giving a medium adapted to the life of the cells, and one in which allosteric changes of various sugars can take place;

3) the formation, with alcohols, of bodies having a cetonic function. Apart from their ordinary action, the various symbionts isolated from animals present secondary differences connected with their origin, which shows that every species has a specific symbiont.

Facts of another order, in appearance very dissimilar to the preceding, may yet be compared with them very profitably.

The author repeated Funck's experiments and those of Weill and Mouton on vitamins and malnutrition (2). He obtained the same principal results as these workers, and gives an account of them.

The animals (pigeons), fed with decorticated grain, lost weight and grew collapsed, showing special trouble in movement.

Vegetable symbionts, similar to those of animals, exist in the tegument and they are absent, or very rare, in the centre part. Pigeons fed on grain with its tegument which has been heated in a moist atmosphere to a temperature above 120°C, lose weight and die, showing the same symptoms as those in the preceding experiment. The same grain heated to 100°C, even to 110°C, keeps the birds alive. The symbionts, in a moist atmosphere, resist to 100°C, or 110°C, but are destroyed at a temperature above 120°C.

Milk drawn aseptically appears always to contain symbionts in the fat. Milk heated to 100°C, or even 110°C, sustains mammals, but, when heated to 120°C, the animals fed on it die (infantile scurvy).

In short, both the destruction and elimination of the symbionts from milk produce malnutrition. It is very difficult to admit that this can be a matter of pure coincidence.

(1) *Comptes rendus de l'Académie des Sciences*, Vol. 165, p. 147, 1917. (Author.)

(2) *Sci. R.* 1916, No. 661.

(E.L.)

If a pigeon suffering from malnutrition and already paralysed and the point of death, is fed with symbionts in some convenient form, it shows a rapid and very striking improvement. The experiments carried out by the author on this subject are few in number and incomplete; but others are in progress.

The symbionts of xylophagous insects, those of the fat tissues of other insects and larvae, the symbionts obtained by culture *in situ* in the fat tissues of vertebrates, may all be shown up by REGAUD's method for the differentiation of the mitochondria. This microscopical method is certain from this point of view that the author always uses it to show symbiotic bacteria in insects.

927 - Gradual Conversion of Colostrum into Normal Milk. — *Oesterreichische Milch-Zeitung*, Year XXIV, No. 14, p. 126, Vienna, July 15, 1917.

During the course of last year the Station for Milk Control at Memmingen (Bavaria) made a series of analyses with the object of following the gradual transformation of the colostrum of milch cows into normal milk. The results of these analyses are given in the appended Table.

Results of Analyses

Age of colostrum in days	Specific weight at 15° C	Fat content	Dry matter	Dry matter devoid of fat	Acidity H ₂ SO ₄	Residue after
1 ¹	1.0345	5.60 %	25.60 %	20.00 %	14.60	—
1 ²	1.0302	3.80	14.62	10.82	9.20	—
1 ¹ ²	1.0350	1.20	14.05	9.85	11.20	—
2	1.0341	3.70	13.22	9.52	10.20	—
2 ¹ ²	1.0365	3.00	14.06	11.16	10.20	—
3	1.0333	3.90	12.90	9.30	9.20	—
3 ¹ ²	1.0335	4.00	14.43	9.43	9.20	—
4	1.0323	3.00	12.65	9.05	8.40	—
4 ¹ ²	1.0337	3.80	13.20	9.44	8.40	—
5	1.0321	3.20	12.84	9.04	8.40	—
5 ¹ ²	1.0331	3.83	13.12	9.29	8.60	—
6	1.0321	3.65	12.66	9.01	8.20	—
6 ¹ ²	1.0322	3.68	12.72	9.04	8.80	—
7	1.0312	3.70	12.50	8.80	8.00	—
7 ¹ ²	1.0326	3.70	12.85	9.15	8.00	—
8	1.0316	3.93	12.51	8.88	8.00	—
8 ¹ ²	1.0324	3.45	12.50	9.05	8.80	—
9	1.0329	3.73	12.95	9.22	8.00	—
10	1.0316	3.70	12.60	8.20	7.20	—
10 ¹ ²	1.0331	3.40	12.61	9.21	7.20	—
11	1.0322	3.58	12.60	9.02	7.20	—

This Table shows that if with certain data, the milk has reached the normal figure as early as the 5th. day, the acidity only becomes normal at the 10th. Further, the relation between casein and albumen and the

itation experiments have shown that the milk is not capable of caseification before the 10th. day and that, for selling milk for direct consumption, it is advisable to wait till the 14th. day, on account of the facility with which milk of the preceding period adheres to cooking vessels and acquires rancid flavour.

Alfalfa Silage. — REED, O. E., in *Kansas State Agricultural College, Agricultural Experiment Station Bulletin No. 217*, pp. 1-20. Manhattan, Kansas, May 1917.

Seven small silos were erected in the spring of 1914 at the Kansas Experiment Station with the purpose of studying alfalfa silage. The experiment was carried on for two years, the silos being filled for the first time in the spring of 1914 and again in the spring of 1915.

The following combinations of material were siloed :

First year	Second year
Alfalfa alone.	Alfalfa alone.
Alfalfa and corn chop, 10 to 1.	Alfalfa and blackstrap molasses, 20 to 1.
Alfalfa and blackstrap molasses, 20 to 1.	Alfalfa and blackstrap molasses, 10 to 1.
Alfalfa and alfalfa-molasses feed, 10 to 1.	Alfalfa and corn chop, 10 to 1.
Alfalfa and straw, 1 to 1.	Alfalfa and sweet-sorghum stover, 6 to 1.
Alfalfa and green rye, 2 to 1.	Alfalfa and green rye 2 to 1.
Alfalfa alone.	Rye alone.

A palatability test, conducted each year, obtained information as to what cattle would relish the various combinations. Chemical analyses were made of the silage by the chemistry department. Bacteriological studies were also made of the silage by the bacteriology department. Some of the animal analyses are reported in this bulletin, but a detailed report of the animal and bacteriological studies will be published separately.

During the first trial several difficulties such as insufficient weight to make proper packing and method of sampling were encountered, but these were overcome during the second trial.

A summary of the chemical analyses of the second year experiments given in Table I. The first analysis in each case represents the composition of the mixture as it was run into the silo. The samples for the second analysis were composites taken several times during the process of silage making and represent the finished product.

The palatability tests showed that the silages containing the highest amount of acid were most palatable to the cattle.

The following deductions were made :

Alfalfa will make a fairly good quality of silage and it will be readily eaten by cattle if fed within a few months after being siloed.

Observations during the experiment indicate that when it is possible to make alfalfa into first-class hay it should not be put into the silo. During any season it is almost impossible to get the hay up without some damage and under such condition siloing may be justified.

The addition of carbohydrate material, such as corn meal, blackstrap molasses, sweet-sorghum stover and green ryes to alfalfa when put into the silo resulted in preserving it for a longer time than when the alfalfa was siloed alone.

TABLE I. -- *Percentage composition of alfalfa silage. Second trial 1915-16*

Silo No.	Description of Sample	Moisture	Ash	Protein	Crude fibre	Nitrogen free extract	Ether extract	Ash-free
1	Alfalfa alone.							
	When filled	62.75	4.60	6.94	10.32	13.03	1.76	0.159
	Taken out	67.43	4.17	5.51	9.75	12.23	1.11	1.48
2	Alfalfa and molasses, 20:1							
	When filled	70.81	3.21	4.75	6.93	13.10	1.18	0.094
	Taken out	73.08	2.80	4.48	7.67	11.00	0.97	2.11
3	Alfalfa and molasses, 10:1							
	When filled	64.85	4.95	5.31	7.53	10.07	1.49	0.38
	Taken out	63.53	5.22	5.93	9.49	14.11	1.30	3.09
4	Alfalfa and corn chop, 10:1							
	When filled	66.80	3.25	5.25	7.21	10.02	1.17	0.378
	Taken out	67.08	5.23	5.10	8.59	12.79	1.20	2.22
5	Alfalfa and sorghum stover, 6:1							
	When filled	64.75	4.15	5.60	10.54	13.27	1.60	0.38
	Taken out	62.30	5.36	5.51	11.26	11.82	1.55	1.86
6	Alfalfa and rye, 2:1							
	When filled	63.25	5.30	6.00	9.23	9.18	1.58	4.82
	Taken out	67.40	4.21	4.93	10.20	11.80	1.41	1.67
7	Rye alone.							
	When filled	62.25	3.65	3.80	6.17	23.05	1.08	0.473
	Taken out	62.27	3.72	3.83	13.17	15.67	1.34	1.07

oed alone. Of the supplements used in these experiments blackstrap molasses proved to be the best, corn chop was next in order, followed sweet-sorghum stover and green rye. The mixture of alfalfa and blackstrap molasses was the most practical one used. Inasmuch as the addition of the molasses to alfalfa did not increase the bulk, it was possible to preserve large quantities of alfalfa within a comparatively small space.

There is as much acid produced in alfalfa silage as in kaffir silage. This would indicate that the acid content of silage is not an index to the quality of the silage.

Rye alone will make a fair quality of silage when preserved in small silos and cut when the grain is in the late milk and early dough stage.

924 - **Studies of Free-Martins.** - I. LILLIE, FRANK R. - The Free-Martins: A Study of Action of Sex Hormones in the Fetal Life of Cattle. In *The Journal of Experimental Zoology*, Vol. 24, No. 2, pp. 141-152, figs. 29. Philadelphia, Pa. July 5, 1917. - HENRI CATHERINE LINES, A Microscopic Study of the Reproductive System of Free-Martins. *ibid.*, pp. 153-162, figs. 10.

A research into the cause of the sterility which is the rule (subject to a few exceptions) in the female of two-sexed twins of cattle. The whole theory has already been discussed in a previous publication (1), the present

per now deals with the data and analyses the facts in a more ample manner.

The view taken by the writer is that the free-martin is zygotically female. The only basis on which it could be logically interpreted as male is that it is co-zygotic with its male mate, because it is impossible to suppose that the association of two males in *utero* should cause the transformation of one of them into a free-martin in a certain definite proportion of cases. The embryological evidence, however, based on the occurrence of a *corpus luteum* in both ovaries of 22 pregnant animals examined by the writer, shows that the free-martin and its male mate arise from separate zygotes. From this point of view the free-martin must be interpreted as zygotically female. Other proof of the author's view is afforded by the somatic resemblance not being as close as that of identical twins and the fact that interpretation of the female as male leads to an absolutely incomprehensible sex-ratio. The fact that the internal reproductive organs of free-martins are more or less of the male type is regarded as inconclusive.

The question now becomes how the association of a male and female in *utero* may affect the female in the way it does.

Examination of twin pregnancies in cows has shown that the chorions of the 2 fetuses usually become fused at an early stage and this is followed by anastomosis of the blood vessels of the two sides with resulting intermixture of the blood of the two fetuses. It is this condition which has suggested the theory of hormones. At the time of sex-differentiation in cattle there is an active secretion of male sex hormones which pass into the blood and thus in the case of twins by means of the vascular anastomosis reach the circulation of the other twin. It is the limiting effect of the male hormones upon the female reproductive organs that causes the sterility of other features of the free-martin. The natural query now is why the intermixture of the blood being reciprocal, the effect is exclusively on the female? The answer is afforded by reference to well-known facts not hitherto correlated with the phenomena in question and in certain new facts which are described in the 2nd. paper, by CHAPIN, to which the reference is given at the head of this summary. These facts are: 1) the early development of the interstitial tissue of the mammalian testis, from the very beginning of sex-differentiation, and 2) the fact that the differentiation of the ovary is later than that of the testis. Thus 1) interstitial tissue of the testis is present at the time for which male hormones are postulated, and 2) the testis has a start over the ovary in this respect which results in the suppression of specific ovarian tissue from the beginning. Hence no conflict of sex hormones arises nor can there be any question of the male of two-sexed animals being influenced in its sexual development by its mate.

It is obvious from the above that the hormone theory of free-martins is based on the fusion of the chorions of the twins where free-martins occur, and anastomosis of the foetal blood-vessels. Consequently, if a single case of two-sexed bovine twins occurred in which the foetal vascular anastomosis was absent and in which the female was nevertheless a sterile free-martin, the hormone theory would have to be abandoned. No such case,

however, has been found; it can therefore be safely said that foetal anastomosis of two-sexed twins involves the sterile condition of the female, and absence of such anastomosis its fertile condition.

The last part of the paper is devoted to the embryonic and adult anatomy of the free-martin, the microscopic anatomy being discussed in the 2nd. paper, by Miss CHAPIN.

Bibliographies are attached to both papers.

930 - **Family Performance as a Basis for Selection in Sheep.** — RITZMAN, E. G. and DAVENPORT, C. B., in the *Journal of Agricultural Research*, Vol. X, No. 2, pp. 374. Washington, July 9, 1917.

Two methods of selecting mates are in current use. The common one is that of picking out the best individuals or those that exhibit the traits which are desired in the offspring, and is based on the principle that the somatic traits of the parent are the best index of its germinal determiners; that somatic selection is, at the same time, gametic selection. This principle is, however, false, because the animal may be heterozygous in any trait that is to say that, besides determiners for a certain character, it may also have allelomorphous cells where this character is absent. For this reason the method gives very slow progress, and sometimes none at all.

The second method of selection is based on the principle that the individual's somatic traits constitute a partial and imperfect index to its germ plasm, and that a better index is obtained by considering the characters of as many close relatives as possible.

These principles have been applied in the sheep breeding experiments carried out at the New Hampshire Experiment Station. The aim of the experiments is to produce a race of sheep combining good qualities of conformation, size and wool. These qualities were judged by the following scale of 100 points:

SIZE. — Body weight, 5 points; height at shoulder, 5 points; chest circumference, 5 points; loin width, 5 points; hind-leg circumference, 5 points.

WOOL. — Weight of fleece, 10 points; length of staple, 10 points; diameter of fibre, 10 points; crimp of wool, 10 points.

CONFORMATION. — Ratio, head width: length, 3 points; ratio, neck length: circumference, 2 points; ratio, fore-leg length: trunk length, 10 points; ratio, chest width: depth, 5 points; ratio, chest width: trunk length, 5 points; ratio, loin width: trunk length, 5 points; hind-croup length: trunk length, 5 points.

As only a few rams are bred, selection is much more rigorous for males. The general method of selection is illustrated by the following example. In the 1916 selection the available ram lambs belonged to 12 "families". A "family" includes brothers, sisters, and the two parents. In selecting the character "body weight", the average weight of all the members of each family group at a fixed age is calculated. The family having the highest average weight is graded 1; the next highest, 2; and so on. If two families have the same average they receive the same number. Naturally each family has different numbers for each character. When the rank of each family with respect to every quantitative trait has been determined

rank is multiplied by its appropriate weight factor, as in ordinary scoring. The family which gives the lowest sum of products grades highest. The rank of the families having been thus established the best ram is selected from each. In this case the individual is also considered. If, for example, the best ram from the best family is sickly or has any physical defect, he is discarded for the best ram of the next best family. Thus the consideration of the relative values is supplemented by that of the "ideal" at which the selection aims.

These experiments are not yet finished, but the uniformity and excellence of the progeny obtained already show that this method is well worth extra labour it entails.

Investigation in Animal Nutrition: Beef Production. — HAECKER, T. L., in *The University of Minnesota Agricultural Experiment Station Bulletin No. 155*, pp. 1-32, St. Paul, Minn., March, 1916.

This bulletin gives the results of 7 years' experiments on the food requirements of beef cattle from their birth up to 1 year, 2 and 2 $\frac{1}{2}$ years of age.

The experiments were started in the autumn of 1891, at the same time those on the feeding of dairy cows, which lasted 15 years, and the results which have been published in Bulletins Nos. 130 and 140 of the Minnesota Experiment Station.

The real experiments on beef-bred calves were, however, not begun on a large scale till 1907-08. The experiments were divided into 5 series, with groups of selected beef calves. Besides a quantitative and qualitative study of the food required for the production of beef animals during the periods of growth and fattening, the cost of production was also considered, though the data included in the second part of this study must necessarily deal only with the cost of foodstuffs, yet they are of great importance, because they clearly show the *progressive curve of the cost of foodstuffs per pound of gain*. Table I summarises, in the last column, the average cost, for the cost of 1 lb. of gain during the six periods of growth corresponding to the classes of animals used in the experiments. The curve is not modified by variation in the cost of foodstuffs. The other columns of Table I indicate the average live weight per class or period, the average increase in weight, the whole milk, skim milk, concentrated foodstuffs, hay and silage consumed during the various stages of growth, as well as the quantity of concentrated foodstuff given.

The data in Table I refer to experiments with steers kept in the shed and never being turned out to pasture, but take into account all liberty necessary to the animal's physical welfare.

Table II summarises data obtained from animals of two groups which, during their 2nd year, were turned out to pasture in summer for 140 and 180 days respectively, and kept in the shed during the period preceeding and following that of open pasture. It is seen that grazing reduces the quantity of foodstuffs consumed, consequently, the cost, of the foodstuffs given during the 21 weeks of the experiment by \$10.55 per head, with a minimum of \$6.6 and a maximum of \$5.0 per head.

TABLE I. Average Weight of Steers, Feed Consumed per Steer, and Cost of Gain during different periods of growth.

Periods Lbs.	Weight Lbs.	Gain Lbs.	Milk Lbs.	Skim Milk Lbs.	Grain Mixture Lbs.	Hay Lbs.	Silage Lbs.	Average amounts of the various Feed-Staffs in the Grain Mixture						Cost per lb. of gain (¢)	
								Corn	Barley	Bean	Oil Meal	Middl.	Oats		
								Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Cents
To 100.	111.7	—	24.1	4.0	—	—	—	—	—	—	—	—	—	—	10.6
100-200.	199.4	87.5	2.6	87.0	98.6	1,00.6	6.0	21.7	6.7	26.8	21.6	7.7	7.7	7.7	7.5
200-300.	290.6	100.4	—	37.7	108.1	4.86	112.3	30.6	21.0	59.3	46.1	16.1	16.1	16.1	4.9
300-400.	401.6	102.0	—	116.3	56.0	297.7	332.3	48.1	28.6	77.3	62.5	19.5	19.5	19.5	5.0
400-500.	502.5	100.0	—	—	301.9	333.8	476.8	62.5	26.7	93.9	71.0	21.5	26.3	26.3	5.5
500-600.	603.5	99.0	—	—	286.8	310.4	417.1	60.9	23.1	80.9	66.6	20.2	26.1	26.1	5.3
From calf to 13 months.	—	489.8	460	1 459	1 138.4	1 594.2	1 365.4	325.5	106.4	841.2	802.8	85.0	95.6	95.6	6.3
600-700.	698.3	96.8	—	—	354.6	430.5	306.6	75.8	28.1	111.5	82.1	24.7	32.4	32.4	6.5
700-800.	800.2	101.6	—	—	131.3	515.2	121.1	95.6	31.3	135.4	102.8	38.9	47.3	47.3	7.5
800-900.	901.4	101.2	—	—	87.5	557.5	377.0	133.4	34.4	155.3	120.4	68.2	64.2	64.2	9.5
900-1000.	1 000.6	99.2	—	—	551.0	450.2	604.1	151.3	57.9	120.1	106.7	67.1	47.9	47.9	9.3
1000-1100.	1 000.6	99.5	—	—	625.6	416.6	871.3	221.7	50.8	110.7	107.2	67.2	59.0	59.0	10.0
1100-1200.	1 200.0	100.8	—	—	740.8	490.5	871.5	330.1	39.3	135.3	125.5	57.3	52.3	52.3	11.2
From 12 to 24 months.	—	599.4	—	—	3 298.2	3 899.3	3 540.9	1 007.9	759.8	2 682	2 646.7	323.4	303.1	303.1	9.0
Total to 100.	1 200.9	1 043.2	460	1 659	4 436.6	4 193.7	4 606.3	1 243.4	357.2	1 115.5	912.5	408.4	398.1	398.1	3.8
Total to 200.	1 392.5	1 190.8	460	1 659	5 511.1	4 919.7	5 610.7	1 395.1	584.9	1 419.9	1 400.1	408.4	398.1	398.1	14.4
Total to 300.	1 400.6	1 284.8	460	1 659	6 174.6	5 749.7	6 463.2	1 552.8	659.2	1 430.7	1 400.1	408.4	398.1	398.1	15.7
Total to 400.	1 500.0	1 384.2	460	1 659	7 030.2	6 509.2	7 284.2	1 730.5	769.1	1 573.4	1 592.4	408.4	398.1	398.1	15.4
Total to 500.	1 500.0	1 384.2	460	1 659	7 030.2	6 509.2	7 284.2	1 730.5	769.1	1 573.4	1 592.4	408.4	398.1	398.1	15.4

The cost of foodstuffs are compared with the prices realised on the Chicago market from 1905 to 1911, and it is shown that these prices are inadequate to cover the cost of production. For this reason many breeders have given up rearing beef cattle and entered the dairy industry. This has resulted in the infusion of dairy blood into many of the large herds of the United States.

TABLE II. — *Results from the lots of groups V and VI on pasture.*

Period	Weight (1)	Gain	Grain	Hay	Silage	Daily Grain	Daily Gain	Grain to 100 lbs.
Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs. Gain
00-800	801.8	94.2	234.8	175.0	718.2	6.4	2.048	249
00-900	904.5	102.7	324.7	207.0	1,100.0	7.1	2.271	318
00-1000	997.0	93.1	423.3	251.4	1,395.1	8.1	1.780	459
00-1100	1,072.8	95.2	513.8	340.7	1,202.0	9.2	1.669	541
00-1200	1,201.1	111.0	582.7	254.5	1,509.7	10.4	1.901	522
<i>all periods</i>	—	496.8	2,019.3	1,231.6	5,811.6	8.23	1.938	412
<i>all steers</i>	691.9	480.6	1,132.3	1,182.3	1,429.3	3.24	1.374	235

(1) Average weight on return from pasture 707.0 pounds.

The production of beef cattle is subject to two different factors: 1) the cost of meat must not be such as to cause a decrease in its consumption; the breeder must make a profit which will enable him to keep in the trade.

The reforms necessary to gain these ends are:

- 1) The difference in prices paid for steers and the price of meat must be decreased.
- 2) The market must be stable, or else such great losses will be sustained by the producers that they will be obliged to give up the trade.
- 3) Experimental, demonstrational and educational work must be directed along practical lines.
- 4) The methods of feeding and handling the steers must be made more economical in order to reduce the cost of production, for economical production and early marketing are as important factors in assuring profit in beef production as a promising and stable market.

The data contained in the tables of this bulletin give useful information in this subject.

1. **Experiments in Feeding for Beef in Canada.** I. BERTON, C. H. and HARRFIELD, W. H., Feeding for Beef in Alberta: Results of Experiments at Dominion Experimental Station in Alberta from 1906 to 1915, in *Dominion of Canada Department of Agriculture, Experimental Farms Bulletin* No. 30, pp. 1-35, OTTAWA, Ontario, 1915. — H. Mc KILLIGAN, W. C., Experiments in Steer Feeding in Manitoba: A Summary of Tests at the Experimental Farm, Brandon, Manitoba from 1912 to 1916, in *Dominion of Canada Department of Agriculture, Experimental Farms Bulletin* No. 31, pp. 1-21, OTTAWA, 1916.

The results of the work done in feeding for beef on the Experimental

Stations in Alberta and Manitoba are set forth in these Bulletins with the purpose of furnishing farmers, interested in this problem, with data applying to conditions prevailing in these Provinces. The importance of finishing beef is emphasized, as the results indicate that operating under average farm conditions the selling of half-finished animals fails to realize the large possible profits. In the southeastern limits of the province of Alberta, however, where young stock can be advantageously produced, natural conditions are such that the growing of finishing feeds is inadvisable. Stock growers in these districts should sell their grown but unfinished steers; the farmer in the districts better suited to grain or alfalfa growing, to finish finally for market.

The results also indicate that the necessary initial investment to provide suitable forms of shelter is relatively small. The financing of such undertakings as far as the purchase of steers is concerned, is facilitated by banks, which view such investments with much more favour than formerly.

I. — The following deductions were made at Lacombe Station, Alberta.

- 1) Three-year-old steers seem better adapted to straight wheat feeding than are two-year-old steers.
- 2) From the results of the six years' work it is evident that low-grade grains may be made to bring the producer a higher price per bushel sold through steers than will high-grade grains sold through the elevators.
- 3) Hay, green feed, and straw may be profitably fed at home.
- 4) From experimental work conducted with grain plots at Lacombe Station, a valuation of the manure produced through feeding cattle at 23¢ per ton applied is warranted. The fertile soil of the western prairies does not retain its fertility indefinitely without a return of at least a portion of the constituents drawn from it in the production of crops.
- 5) It is not necessary to provide an elaborate equipment in order to be able to undertake the satisfactory feeding of steers for the production of beef in this climate.
- 6) From the figures submitted it would appear wise for the breeder to be a feeder also and market his product in finished condition.
- 7) The increased demand and higher price paid for beef cattle in the autumn has resulted in higher prices for stockers. It is not likely that a wide spread will obtain in future between stocker cattle in the autumn and beef cattle in the spring, as was the case during the early years of experimental feeding.
- 8) That the purchase of stocker cattle in the spring to make use of otherwise waste pasture is likely to prove a profitable undertaking.

The results of the Lethbridge Station, Alberta, showed that, where alfalfa fed in the tests \$12 per ton, a net profit has been shown each year. The average gain per day per animal was not great during the winter on account of the light grain ration adopted, in view of the fact that the average farmer has an excess of alfalfa as compared to the quantity of grain for feeding purposes.

In the first winter the average daily grain ration was 8.3 lbs. and the daily gain was 1.77 lbs. In the second winter the average daily

It was 7.4 lbs. per day and the gain was 1.55 lbs. per day. In the first winter the average grain fed was 5.7 lbs. per day and the average gain was only 0.66 lbs. per day. Judging from these tests it would seem that it would not pay the farmer to feed less than 6 lbs. per day for the first feeding period, and if at all possible he should arrange to feed an average of between 8 and 9 lbs. The steers should be started with a very small allowance, say 2 lbs. a day, and kept at this amount till all become accustomed to eating it, then increased gradually. For the last three or four weeks of the feeding period they should be increased to 12 or 14 pounds daily. Hay of the best quality should be reserved to feed during this period.

II. The most important conclusions from the experiments conducted at the Brandon Experimental Farm, Manitoba, may be briefly expressed as follows:

- 1) Steer feeding may be profitably carried on in Manitoba.
- 2) Good results can be obtained with no other feeds than straw and grain.
- 3) The addition of succulent feed such as roots or ensilage improves a ration.
- 4) Hay and oat sheaves are very useful and give larger gains than straw.
- 5) Alfalfa and corn are especially valuable on account of their feeding value combined with large yields.
- 6) Between two and three years appears to be the best age at which to fatten.
- 7) Only steers of good beef type should be used.
- 8) There should be a margin of at least 1 1/4 cents per lb. between buying and selling prices in order to make a profit.
- 9) Steers fed loose in a box stall do better than when tied.
- 10) Dehorning gives little or no setback and makes loose feeding profitable.
- 11) Steers may be fattened successfully outdoors in winter in Manitoba if sheltered from the wind.
- 12) Steers fed in a stable will make greater gains than when fed outdoors, but probably not sufficient to pay for an expensive stable.
- 13) Coarse grains, whether oats, barley or low-grade wheat, can be fed more profitably through steers than through the elevator.
- 14) The farmer who raises a good steer and sells him thin or half-shod usually loses the best part of the profit.

The By-Products of the Decortication of Rice ("pula vergine") in the Feeding of Working Oxen; Experiments in Italy. — PROCCUR, ANTONIO, in *La Chimica Industriale*, Year 30, No. 11-12, pp. 428-437, Milan, July 30-August 15, 1907.

This paper deals with experiments carried out in connection with the 4th Veterinary Corps at Milan at the Zootechnical Institute of the Milan and High School of Agriculture, because of the good results obtained

by Prof. RENZO GIULIANI in the use of the by-products of the decortication of rice for feeding dairy cows (1).

The experiments were undertaken to determine :

- 1) The average amount of hay to be replaced by 1 lb. of these by-products in a ration of draught oxen ;
- 2) The methods of preserving and distributing this food ;
- 3) Its influence on the health, weight and working capacity of the experimental animals ;
- 4) The economic advantages to be gained by using these by-products in the place of hay.

Twenty draught-oxen of the Schwyz, Podolia, Dutch, Brescia and Bergamo breeds, were used for the experiment.

During the preparatory period of 15 days (from the 15th. to the 29th. November, 1916) the following ration was given : 37 $\frac{1}{2}$ lbs. of alfalfa hay and clover mixed in the ratio of 9 : 1 respectively and 4 $\frac{1}{4}$ lbs. of good quality wheat straw. The composition of this ration is shown in Table I.

TABLE I. — *Composition of the ration given during the preparatory period.*

	Total dry matter	Digestible substances					Total Nitrogen in the ration
		Albumin	Starch	Crude protein	Fat	Nitrogen-free extract	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Hay 37 $\frac{1}{2}$ lbs.	30.236	1.801	11.990	2.560	0.260	9.708	5.143
Straw 4 $\frac{1}{4}$ lbs.	3.550	—	0.475	0.017	0.017	0.585	0.807
Total	33.786	1.801	12.465	2.577	0.277	10.293	5.950

The "pula vergine" used in the experiment was guaranteed to contain a total of 24 % nitrogen and fat ; it was free from the awns and small bits of ground bran which are found in more or less large quantities in all the qualities of "pula vergine".

In order to ascertain the quantity of hay to be replaced by 1 lb. "pula vergine", the two foods were analysed and their starch values determined. The results are given in Table II.

TABLE II. — *Chemical composition and starch value of hay and "pula vergine".*

Composition per cent	Hay	"Pula vergine"
Moisture	10.15	10.60
Ash	6.30	10.15
Crude protein	9.20	11.55
Crude fat	1.42	13.60
Fibre	23.31	0.00
Nitrogen-free extract	19.56	40.50
Digestible protein	6.88	8.90

(1) See R., January 1917, No. 56; R., August 1917, No. 77.

value of 100 lbs.:

100 lbs. crude fibre	$1.82\% \times 0.94 =$	1.530	$7.85 \times 0.94 =$	7.379
100 lbs. fat	$0.714\% \times 1.91 =$	1.364	$11.56 \times 2.12 =$	24.507
100 lbs. nitrogen free extract	$25.958\% \times 1 =$	25.958	$32.08 \times 1 =$	32.080
100 lbs. starch	$13.752\% \times 1 =$	13.752	$1.35 \times 1 =$	1.350

Total 45.693 = 65.316

Product

of total crude fibre $\times 0.55$

13.519

Actual Starch value 37.864

65.316

of full food value "pula vergine", therefore, replaces 65.316: 32.084 1025 lbs. of hay, or, in round figures, twice its weight.

From the 30th. November to the 2nd. December, up to 6½ lbs. of hay were fully replaced by half its weight of "pula vergine"; from the 2nd. December 1916 to the 3rd. January 1917, 30 lbs. of hay = 3¼ lbs. of "pula" + 1½ lbs. of wheat straw, were given, and from the 4th. January to the February; 28½ lbs. of hay + 4½ lbs. of "pula" = 4½ lbs. of wheat w. per head per day.

The oxen immediately ate the "pula" greedily, and no trouble was felt in the state of their health. Their weight varied slightly in both directions; on the whole they showed, during the experimental period proper speaking, a slight increase of 102 lbs. The inclusion of "pula" in ration has no detrimental influence on the working capacity.

With the present price of 5s. 8d. per cwt. fixed for "pula vergine" by decree of the 12th. November, 1916, by the Home Office and Department of Agriculture, and of 4s. 8d. per cwt. for hay (requisition price), if instead of "pula" is given in place of 2 cwt. of hay, there is a saving of 6s. 5s. 8d. = 3s. 8d.

The author points out that, contrary to Prof. GIULIANI'S experience with dairy cows, none of the oxen fed with "pula" suffered from coughing, is probably due to the fact that, in the latter case, the "pula" used was completely free from awns and scales, whereas the cows had been with 1st. and 2nd. quality "pula" containing "tondello" and "fuso" (1) with minute scales and awns, which, lodging in the mucous membrane, had probably caused fits of coughing.

CONCLUSIONS

The preparation of rice includes the following principal operations:

1) cleaning; 2) hulling; 3) milling; 4) polishing. The first operation, carried out manually, frees the paddy from dust and foreign matter. The second frees the rice from husks or hulls, by means of a huller. The third operation removes the bran coat; for this purpose either a bran reel or a pearling cone is used, and the rice passed through it 3 or 4 times, being sifted and fanned between each process. The product thus obtained is the white rice. The fourth operation subjects the commercial rice to long and gentle heat by mixing it, drop by drop, with fine, colourless oil. This gives "camolino" rice, the process is continued and special ingredients used (glucose, talc, etc.), polished rice, by-products obtained from the preparation of rice are: 1) "lolla" or "pulone" (large and their derivatives, "ros-betta", "tondello" and "fusetto"); 2) "mezza grana"; 3) "risina" or "pistino"; 4) "pula", "Lolla consist entirely of the glumes of the cereal;

934 - **Fertility and Age in the Domestic Fowl.** — PEARL, RAYMOND, in the *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 3, No. 5, pp. 350-356, Washington, D. C., May, 1917.

MARSHALL (1), PEARL (2) and KING (3) have already shown that in a large number of different mammals fertility varies in a definite way with the age of the animal. Low at the beginning of sexual life, fertility increases till a maximum is reached, when it begins to decrease till, at a certain age, total sterility is attained. MARSHALL considered the domestic fowl showing the same sort of change, basing his opinion on statistics which the author proved to be inadequate. Recently the author has again studied the question, on the basis of 1114 matings of Barred Plymouth Rock hens during a period of 9 years.

The author defines fertility as the total net reproductive capacity of pairs of organisms, male and female, as indicated by their ability to produce viable offspring. To measure this he used an index RI which represents the percentage of viable offspring produced from a particular mating compared with the maximum number physiologically possible during the time the mating lasts. With this he drew up the formula

$$RI = 100 C : Em$$

in which C is the number of chickens produced from a mating and alive at the end of the third week after hatching, and Em the total number of eggs from the day when the mating started till the day when the last egg is its incubation.

This index would be 100% i. e., maximum fecundity would be attained, if, during mating, the hen laid one egg each day, if each of these eggs were fertile, and if each embryo hatched and lived three weeks.

The following results were obtained:

Weighted average reproductive indices for males of specified ages mated with females of all ages.

Age	Average RI.
Male, 1 year	12.56%
2 years	10.21%
3 years	9.62%

When coarsely milled, this becomes "ruschetta". This product, after being crushed, is softer and less easily recognisable, is used chiefly to adulterate wheat bran, before milling and passage through a double sieve, "bolla", "tondello" and "funetto". The first of these resembles a fine bran and appears to be formed of minute scales with small awns; the second, on the contrary, is like flour. "Funetto" always contains certain amount of mineral dust. "Funetto" and "tondello" are mixed with the "pula". The "mezza grana" is composed of small or broken grain; the "risina" or "risini" fragments of grain. "Pula" is the residue left from the successive passages of the rice through the reel or pearling cone at the expense of the tegument and the germ of the rice grains. RENZO GIULIANI, *Esperienze sull'uso della pula di riso come alimento delle vacche*, *La Clinica Veterinaria*, Year XL, No. 13, pp. 384-392 and No. 14-15, pp. 404-417, July 15 and July 30-August 15, 1917.

- (1) MARSHALL, F. N. A., *The Physiology of Reproduction*, London, 1910, pp. 1-10.
- (2) PEARL, R., *Science*, New York, N. S., Vol. 37, pp. 226-228, 1913.
- (3) KING, H. D., *Avian Record*, Philadelphia, Vol. II, pp. 269-280, 1915.

Weighted average reproductive indices for females of specified ages mated with males of all ages.

Age	Average R. I.
Female, 1 year	12,765
" 2 years	11,660
" 3 years	10,722

These figures show that fertility, as measured by the index, decreases with advancing age in both sexes, but more rapidly in the male than in female.

Weighted average reproductive indices for matings of individuals of specified combined ages.

Combined ages of individuals when mated	Cases	Average R. I.
2 years	746	13,083
3 "	393	11,121
4 "	113	11,115
5 "	12	7,452

After a combined age of 4 years the cases were too few to give definite results. Up to that age the figures show a great drop in reproductive ability when passing from a combined age of two years to one of three years, in passing from three to four years, there is little change, but that there is another large drop when passing from a combined age of four years to one of five years.

These results show that the law of fertility which has been found to hold for mammals does not apply to fowls, which show a steady and progressive decline in fertility after the first breeding season.

The Feeding of Poultry. — *The Journal of the Board of Agriculture*, Vol. XXIV, No. 2, pp. 180-187, London, May, 1917.

In view of the necessity of reserving as much grain as possible for human consumption it is necessary to ascertain whether poultry keeping increases or decreases the national food supply. In order to solve this question the President of the Board of Agriculture calls the attention of poultry-keepers to the following facts.

On an average, an 18 months old pullet has eaten 100 lbs. corn and meal, her equivalent in other food-stuffs, it has laid 180 eggs, and, when killed, she is about 4 $\frac{1}{2}$ lbs. The dry edible human food contained in its carcass and in the eggs it has laid is about 6 $\frac{1}{2}$ lbs., so that it has eaten about 95 lbs. of corn and meal, or their equivalent, per 1 lb. of human foodstuff faced. Therefore, if the grain and meal eaten by the hen are fit for human food, poultry-keeping reduces the national food supply. On the other hand, if the pullet is fed on scraps, waste, tail corn, or other materials unfit for human consumption, the national food supply is increased.

If this test be applied to other animals, the pig is found to be a more economical source of food. The following suggestions are, therefore, made to poultry-keepers.

- 1) Poultry should be kept in small numbers only, so that they may be fed exclusively on scraps or other material unfit for human food.
- 2) When the quantity of such food available is sufficient to keep the pig, the pig should be preferred to poultry.
- 3) At the end of the laying season the number of hens kept should be reduced, and the number of poultry kept for fattening restricted to an amount of material unfit for human consumption available for feeding them.

936 - **Parthenogenesis in the Silkworm** (1). — LECAILLON, A., in *Comptes Rendus et Stances de l'Académie des Sciences*, Vol. 165, No. 5, pp. 192-193, Paris, July 1916.

In 1916 and 1917 the author continued the studies, undertaken in 1914 and 1915, on the importance of the change in colour which occurs normally in certain unfertilised eggs of *Bombyx mori*, and on the formation, in this species, of larvae of parthenogenetic origin.

The unfertilised eggs used were taken from 130 females of the same univoltine breed as those of the previous experiments. There were about 26 000 eggs in all, each moth laying an average of 200.

The results were as follows:

a) After remaining pale yellow for some days, like fertilised eggs, the unfertilised eggs break up into two groups: 1) those which undergo incomplete and abnormal segmentation, which keep their colour and degenerate, and 2) those which continue to develop and become either completely or partly pink or reddish, according to the degree of development reached.

b) The eggs of the 2nd. group again subdivide into two groups: 1) those which degenerate, and 2) those which continue to develop.

c) These, in their turn, become slate grey; 1) some degenerate, and 2) others give rise to larvae which may be seen if the eggs are opened.

d) Finally, these last again subdivide into two groups: 1) those which degenerate, and 2) those which hatch and give living larvae.

In his experiments the author noticed that numerous larvae died in the egg, in many cases 12 to 20 of the total number laid.

Eight live larvae were obtained from a total number of 20 eggs laid at one time; of these eight, four were bred without difficulty.

The preservation of unfertilised eggs is more difficult than that of fertilised eggs. By improving the methods of preservation it would presumably be possible to obtain a larger number of larvae adapted to normal life.

937 - **The Best Silkworm Hybrids of the First Generation**. — *Bulletin de l'Association Sericicole du Japon* (abstract from the *Bulletin de l'Institut National de Sericulture*, Year 2, No. 10, pp. 4-5, Tokyo, May 1st, 1917).

This bulletin asserts, without giving any reason why, that the hybrids of the first generation are really strong.

The following table, compiled from the results of many experiments, shows which are the best hybrids.

Variety	Duration of breeding		Mortality during breeding	Proportion of double cocoons	Length of thread	Richness in silk	Standard
	days	hours	per cent.	per cent.	turns of reel	gr.	denari (1)
Japanese hybrids . . .	20	8	14.4	12.6	639.7	0.2288	3.01
Sino-European hybrids . .	31	11	12.2	7.5	644.1	0.2576	3.26
European hybrids . . .	29	17	12.2	4.8	726.1	0.2612	2.90
Sino-Japanese hybrids . . .	31	21	12.2	10.4	561.3	0.2696	3.00
Chinese hybrids . . .	29	9	14.7	7.1	937.9	0.2176	2.74
Sino-European hybrids . .	31	0	14.6	1.8	729.1	0.2585	2.83
and breeds from Japan . .	32	6	20.9	8.9	541.6	0.2941	3.02
" China . .	29	9	18.4	5.0	610.0	0.2611	2.75
" Europe . .	32	5	22.1	2.4	719.4	0.2435	2.74

The breeding of the hybrids of the first generation is usually shorter than that of all, or nearly all, the original breeds. In this respect there is a little difference between the hybrids of the first Sino-Japanese and Sino-European hybrids and the original Chinese breeds, but when compared with other breeds, the time required is perceptibly shorter.

The mortality during breeding is rather less (from 10 to 15 %) for the hybrids of the first generation than for all the original breeds.

The proportion of double cocoons is rather larger (except for the Sino-European hybrids) in the hybrids of the first generation than in all the original breeds. It is highest in the Sino-Japanese hybrids.

The thread is longer in hybrids of the first generation than in all the original breeds.

The silk from hybrids of the first generation seems much richer and usually finer than that of the original breeds. There is very little difference in the quality of the silk of Sino-Japanese and Japano-European hybrids and that of the original Japanese breeds. In the Sino-European hybrids the quality is slightly higher than that of the European breeds only, whereas that of the Japano-Japanese, Sino-Chinese and Europeo-European hybrids differs but very slightly from that of the original breeds.

Some of the hybrids of the first generation when crossed show variations, but these are only very slight.

The Sino-European hybrids of the first generation give the best results from every point of view. The Sino-Japanese are inferior to them in that, where white cocoons are concerned, are usually superior to the native breeds.

(1) denari = 0.05 gr.

- 938 - **The Biology of the Spawning Migration of Shad (*Alosa* spp.)** — ROUTE, LOUIS. *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXX, No. 15, pp. 705-707, Paris, July 28, 1917.

Commenting on Prof. BOUNHIOL's paper on the spawning migration of *Alosa finta* Cuv. of the Algerian Coast (1), the author states that many observations made during the course of his studies show that, also in the case of French river shad (*Alosa alosa* L. and *A. finta* Cuv.), the spawning migration seems to be determined by a respiratory tropism; owing to their respiratory needs the fish go where the oxygen content is highest.

If, on the whole, this determinism is in agreement with that of other river spawners, yet it differs from it in many details to which the author draws attention.

- 939 - **Carajat Incubator for Hatching Trout Fry.** — GERDIL, H., in *La Vie aquicole et piscicole*, Year 7, No. 35, pp. 151-151, Paris, September 1, 1917.

The author describes an incubator, called "*Le Pisciculteur*", invented by M. CARAJAT, and gives an account of the excellent results which have been obtained with it.

The apparatus consists of small hexagonal tubes, 30 to 40 mm. long, joined together in groups of 500 or 1000. Each of these tubes has a diameter of 6 mm., just a convenient size for taking one trout egg. The tube is open at both ends.

The group of similar small tubes or cells forms a frame resembling honeycomb. These frames are made of varnished cardboard, a light inexpensive, resistant material which does not lose its shape in water.

Two opposite walls of the hexagonal cell curve out so as to form two buttresses, which partially close the cell, by dividing it into two unequal cavities communicating one with the other. One of these cavities is 7 mm. high, and the other, which occupies the rest of the cell, 28 to 30 mm. high.

To fill the incubator the frame is placed flat with the cavities on top, and the eggs spread over the surface. One egg falls into each cell.

The two sides of the frame are then closed by means of a brass net with apertures of about 1 mm. These nets are fixed on to the frame with 6 metal catches.

As the eggs are in the small cavities near the net they can be watched during incubation.

The incubator may be put into any water so long as it is ventilated. It should be placed edgewise, facing the current, if there is any. If the current is too strong the incubator must be protected by wicker-work or some other arrangement for modifying the speed of the water.

When the apparatus is immersed, care must be taken to ascertain that no air-bubbles are left and that the eggs are well in the water. As the eggs are separated there is no danger of contamination.

The fry may be kept in the cells and thus protected from their enemies till they have reabsorbed their umbilical vesicle. In this case the eggs are

(1) See *R.*, August, 1917, No. 751.

put in the large cavities and it is not necessary to put the net over the side corresponding to the small cavities; the narrow division is sufficient to preserve the egg, but, after hatching, it allows the fry to escape into the open water.

M. CARAJAT'S incubator has been tested in various parts of France under the most diverse conditions, and has always given excellent results. The yield obtained varied between 93 and 99 %.

FARM ENGINEERING.

Machine Cultivation Trials at Mettray, France. — SAGNIER, HENRI, in *Journal d'Agriculture pratique*, Year 81, No. 15, pp. 283-285. Paris, July 26, 1917.

According to the Ministerial decree, the Trials at Mettray (Indre-et-Vienne) were solely to concern machines for cultivation of vines and plants in lines.

Nine machines were entered, but only two took part in the trials, the small H. P. Avery from the firm of PULTER of Paris, and the 12 H. P. Misvalley from Messrs. JOUHET and BLAIN-MISTAL of Paris, machines already noticed at previous trials.

The chief difficulty in cultivating vines by tractors lies in the distance between the lines: their breadth requires a fair width; in vines planted close together they are either unable to enter, or they damage the branches and roots.

At Mettray, the two tractors could only cultivate when a breadth of foot was available between the vines. In this case, the Misvalley tractor towed a 9-tine cultivator 173 yards in 5 minutes, while the small Avery towed a 12 spring-tine harrow the same distance in 4 minutes. For both machines, turning at the end of the line required 30 seconds.

Trials with plants in lines were carried out on hoeing mangels, potatoes, beans, and maize (for forage).

The mangel field was 379 yards long, the distance between the rows being 28 ins. The Misvalley, towing a MASSEY-HARRIS 6-tine cultivator working 2 rows at once, crossed the field in 14 minutes; the Avery with 2 LAMET hoes required 13 min. 20 secs. For both machines turning required 20 seconds.

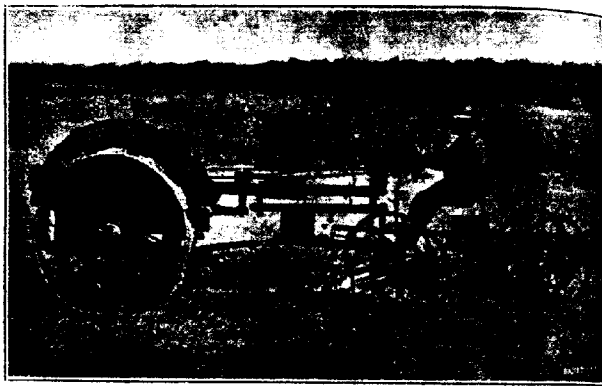
The potato field was 49 yards long, with an 8 % slope; the distance between the rows was 31 ins. Misvalley ascended the whole slope in 2 min. 15 secs., descending in 2 minutes; the small Avery went up in from 2 mins. 1 sec. to 2 mins. 48 secs., descending in 2 min. 10 secs. to 2 mins. 5 secs. The time occupied by turning was 15 secs. for the former and 2 for the latter.

The bean field was 130 yards long, with a 20 % slope over a length of 22 yards; the rows were 29 inches apart. Misvalley required 4 min. 5 secs. to 4 min. 59 secs. to mount the slope, descending in 3 min. 8 secs., while turning required 24 secs. The small Avery mounted in 5 min. 1 sec., coming down in 5 mins., and turning in 30 seconds.

During these trials the General Agricultural Committee and the Wine growers' Association of Indre-et-Loire organised trials for special vineyard hoes, three machines taking part. Machines are wanted which will cultivate between the vines economically and automatically; it seems a difficult aim, as the vine must not be damaged. The vineyard-hoes were towed by tractors, which moved forward only slowly.

941 - **The Moline Farm Tractor.** -- I, *Il Giornale di Agricoltura*, Year 7, No. 46, pp. 139-136, 2 fig. Vercelli, May 30, 1917. -- II, *Engineering*, Vol. CIV, No. 2692, pp. 131, 2 fig. London, August 3, 1917.

The MOLINE tractor is designed so that it can either serve as a tractor or as a motorplough, motorharvester, etc., the latter combinations being obtained by changing the back wheels.



MOLINE Farm Tractor.

The tractor has two driving wheels in front (diameter 51 ins., with in. tyres), fitted with strakes to give a grip on the ground. One of the wheels may be adjusted so that it can run in the furrow and yet maintain the machine horizontal.

The tractor has 2 opposed horizontal cylinders, giving 10 to 11 HP on the belt. It drives through gearing and a differential; there is one speed forward and one reverse. The gear box is placed with the differential between the driving wheels.

The driver always rides on the implement and not on the tractor, having all the controls of both motor and implements ready to hand. The high tension magneto, the radiator with fan, the petrol tank, etc., are all grouped between the 2 driving wheels.

Set up as a tractor with the two back-wheels (diameter 23 ins., width 1/2 in.) the machine weighs 25 cwt; the overall width is 4 ft. 6 ins. Used as

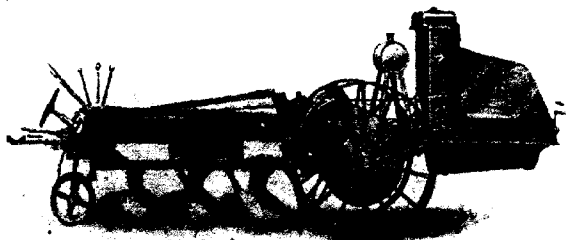
high, 2 "Moline" plough bodies are provided. It is easily controlled and works a depth of 10 ins.

This tractor is at present being tested at the Experimental Station for growing at Vercelli, Italy.

The Crawley Agrimotor. — *The Implement and Machinery Review*, Vol. 43, No. 508 (pp. 311-312, fig. 2, London, August 1, 1917).

This motor plough (1) is easily converted into a tractor for pulling a rivator, binder, mower, or other agricultural machine.

It is driven by a four-cylinder vertical petrol engine capable of developing 30 h. p. at 900 revolutions per minute. The top half of the ink case carries the whole of the mechanism of the engine, whilst the bottom half constitutes an oil well. Electric ignition is provided by a



CRAWLEY Agrimotor.

glut-tension Dixie magneto of a new type. Two speeds forward and a reverse are provided. Gear drive is employed throughout, no chains being used. The main gear wheels, which are of a cast-steel alloy, are bolted to travelling wheel hubs and driven by hardened steel pinions sliding on castellated shafts, thus giving an independent drive to either travelling wheel.

Steering is effected by means of a hand wheel operating a rack and pinion, the patent locking-steering gear employed making the machine self-locking on the straight, whilst the turning is accomplished by engine power. All the operating levers are conveniently arranged in a compact cast steel gate fixed at the rear of the machine, and within easy reach of the driver's seat.

1. The following is extracted from "Notes de Culture Mécanique." Weight 5582 lb. Length 11 feet 3 inches, breadth 6 feet 1 inch, height 5 feet 3 inches. Travelling wheels: breadth 5 inches, diameter 1 foot; rear wheel: 3 inches, diameter 1 foot. Price: £350 10s. (d. Has been bought at Chelmsford and Cambridge (1918). Dr. CROUVYER, *Notes de Culture Mécanique*, published by *Ballière*, Paris, 1917. (174)

It is claimed that with this agrimotor an acre of average land can be ploughed in 2 hours on a petrol consumption of 2 gallons, and the width of the furrow can be altered as desired.

This machine is made by the Crawley Agrimotor Co., Saffron Walden, Essex.

943 - **The Schlenker Motorplough.** — *Wiener Landwirtschaftliche Zeitung*, Year 67, Nos. 60 and 61, pp. 427 and 435, 3 figs. Vienna, July 28 and August 1, 1917.

The new motorplough invented by an Austrian, Dr. SCHLENKER, Linz, and tested on June 9, 1917 before the Royal Agricultural Society of Austria, presents a quite new system.

The motorplough can also be used as a tractor for agricultural machines and waggons or for driving a thresher.



SCHLENKER Motorplough.

Its chief points are :

Weight 20 cwt. ; very powerful ; length = 15 ft. ; height = 5 ft. ; working depth adjustable even during work, while the plough bodies are lifted up by means of the engine ; angle of a adjustable ; plough bodies displaceable forwards, laterally, or to the rear ; engine has next engine completely under control ; sudden stops possible ; only one person required to control the machine ; turns in a small area ; simple construction ; a single driving wheel placed front of the plough ; easily convertible to other agricultural uses, etc.

The Schlenker motorplough, reproduced in the above figure, is made by the " Motor - und Motorpluggesellschaft " of Linz, Austria.

944 - **Patent Stone, Sand and Asphalt Distributing Machines.** — *Engineering Record*, Vol. 70, No. 4, pp. 110-112. New-York, July 26, 1917.

To reduce to a minimum the labour required for road construction, A. JOHNSON, division engineer of the Massachusetts State Highway Commission, has patented a mechanical stone and gravel spreader, to work in combination with a bitumen - spraying truck.

In construction and operation the new machine is exactly similar to a manure spreader in general use, indeed, experiments with a manure spreader for spreading small stones suggested the use of the stronger machine described.

Simultaneous Harvesting and Breaking-up of Stubble with a Tractor. — RINGELMANN, M., in *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Vol. 127, No. 3, pp. 594-596, 2 fig. Paris, May-June, 1917.

To carry out harvesting and breaking-up of stubble simultaneously with a tractor, the harvester may be placed either in front or behind of the cultivator; in the first case, the cultivator should be placed on the side opposite to that of the harvester; in the second, it can be attached in the mid-line.

The writer assumes that the harvester-binder has a knife blade either 6 or 7 ft. long, and that the cultivator either 6 ft. wide with 13 tines or 7½ ft. wide with 17 tines. A knife blade 5 ft. long may be used. Fig. 1 shows the arrangement of a cultivator and a harvester-binder both coupled to a draw-bar ef drawn at r by the tractor; the cultivator C may be attached to b while the harvester M cutting the crop R is attached at a .

A space b is left between the wheel of the cultivator C and the pole a of the harvester of at least 20 inches, so that the minimum length ef is equal to half the width d of the cultivator plus 6 ins. For a 13-tine cultivator (69 ins. broad and 83 ins. away from the eyes of the wheels), the length of ef would be 61 to 63 ins. With the arrangement in fig. 1, the pole a is sufficiently long, and turning to the left at the headland would be awkward were a greater radius required.

When coupling the tractor at b and placing the pole a of the binder M in the line of traction of the cultivator C , there is danger, given the dimensions d of the machines, that the knife-blade would have to be reduced too much.

On the other hand, coupling the binder to the cultivator-frame is difficult, because the tines have to be lifted for turning.

Fig. 2 shows a plan for coupling a harvester binder and cultivator to a tractor. However, as the binder-frame is not designed for transmitting the tractive effort, it must be strengthened by special parts consisting of

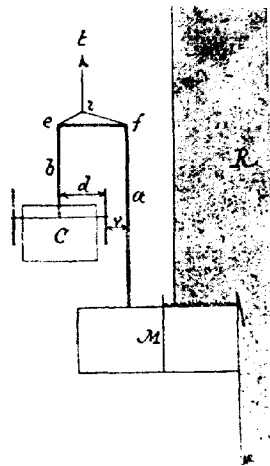


Fig. 1. Plan for coupling a cultivator and a harvester-binder to a tractor.

iron bars held by stirrups and so designed as to cause the driving-wheel of the harvester to grip the ground.

In fig. 2, the harvester-binder *M*, harvesting the cereal *R* in the space between *y* and *y'*, is coupled by *a* to the tractor *T* proceeding in the direction of the arrow *f*. The cultivator *C*, coupled by *b* and placed in the mid-line along *a* works in the space *y''* - *y'''*, leaving a distance *l* between *y'* and *y'* for the passage of the tractor *T* on the following turn; the sheave

should be discharged outside the point *y'''* of the cultivator. The knife bar of the reaper can begin to cut at distance *u* of about 32 to 35 ins. from the mid-line *a*. In working, some 12 inches of the knife blade are used; so that, in reality, a binder with a 71 inch knife bar only cuts a width of 59 to 63 ins. Again, an 81 inch knife bar only cuts a width of 67 to 75 ins.

If the frame of the harvester-binder cannot be strengthened between *a* and *b*, the cultivator-coupling should be moved a little to the left, increasing the width *l*; in this a compensation is made for the resistance caused by the dividing wheel *S* of the harvester, but it should be seen that the cultivator does not foul the sheaves.

In calculating the total average traction of a harvester binder according to the formula:

$$t = r + k P'm,$$

where *t* equals the average resistance of road (not working) resistance, which is an average of 37½ lb. for a 60 in. machine and 40 lb. for an 81 inch machine, and allowing 10 per cent variation for the figures quoted.

k = an experimental coefficient, which

the average 62, with 4 % variation according to the type of machine,

P = the weight of the crop in lbs. per sq. ft.

m = the length of the knife bar actually used.

an average total resistance of 561 to 574 lbs. is obtained for machines having a 61 in. knife-bar, and 642 to 656 lbs. for machines with an 81 in. knife-bar, the figures referring to heavy crops of wheat (33.3 imp. bush. per acre) with a total weight of 20240 lbs., that is *P* = 0.19 lbs. per sq. yd.

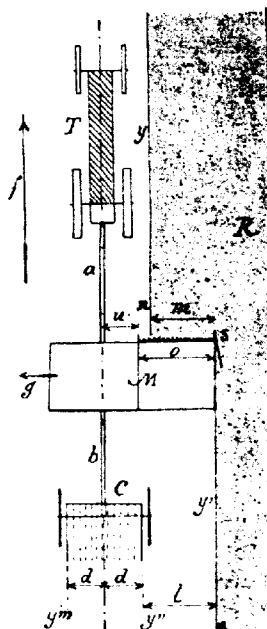


Fig. 2. — Plan for coupling a harvester binder and a cultivator to a tractor.

A cultivator with 13 spring tines working on dry stubble, at 2 to 3 ins., requires a tractive effort of 99 lbs., a 17 tine cultivator requiring a of 1298 lbs. Adding these figures to those for the harvester-binder, we get the average total tractive effort required from the tractors under the above conditions.

Table showing the average total tractive effort required from the tractor.

Harvester-binder, length of knife bar	74 ins.	82 ins.		
number of tines	13	17		
width of work	60 ins.	50 ins.		
length of knife bar	59 ins.	63 ins.	71 ins.	75 ins.
of harvester-binder	864 lbs.	574 lbs.	642 lbs.	656 lbs.
of cultivator	99 lbs.	99 lbs.	1309 lbs.	1298 lbs.
Total	1450 lbs.	1574 lbs.	1951 lbs.	1954 lbs.

In the first case (1550 lbs.) with a speed of 43 ins. per second (about 2.5 miles per hour) the average power of 10 H. P. is required from the tractor, which means the engine will develop about 20 H. P.

At the same speed (2.5 miles per hour), the last case (1965 lbs) requires 13 H. P. from an engine developing 26 H. P. With the reserve power required for slopes, etc., the writer thinks that the knife-bars should not exceed 71 in., while the cultivators should not have more than 13 tines (ins.) so as to use 25 H. P. tractors.

With 20 H. P. tractors, a harvester-binder with a 59 inch bar may be used, the cultivator going twice over certain parts of the work.

Ploughing up stubble immediately after harvesting has the advantage of improving soil drainage while the slightest rain has a useful effect on nitrification. As disadvantage, carting the sheaves is more difficult. In any event, however, when the advantage is taken into consideration.

Clover Seed Stripper. — *United States Department of Agriculture Weekly News Letter*, Vol. IV, No. 41, p. 1. Washington D. C., May 16, 1917.

A homemade device for gathering crimson clover seed, which the farmer may make and use with a small outlay of time and money, is described in Farmers' Bulletin No 646. The handicaps under which crimson clover seed production in the United States have laboured have necessitated the importation of from 3 to 5 million pounds of seed annually. The farmer on the ordinary farm may make arrangements to save his own seed for seeding purposes by the use of this simple device, which is made as follows:

The stripper is designed to be hung on the axle A between two wheels. The wheels, however, are not shown in the drawing. The iron hooks G are used for attaching the stripper to the axle. The hook G should be of such length as to allow the bottom of the stripper to miss the ground by 6 inches. The handle M permits the teeth to be raised or lowered to catch the heads of the clover at the proper height. The limits through which teeth may be raised or lowered are fixed by means of the slot T. This prevents either the front

or back of the machine tilting enough to strike the ground. When it is desired to hold the stripper rigid the removable bolt *C* can be taken out and inserted in one of the holes *E*. Bolt *D* should fit loosely in the bottom of board *B* to permit easy action of the attachment. It is necessary to have a plank *N* to which the whiffletree is attached fastened to the shafts far enough in front of the teeth to prevent the horse's hoofs from coming in contact with the teeth of the stripper. The teeth are sawed out of oak boards, which in turn are nailed to planks *H* and *K*. This stripper can be made on the farm from readily available material at the expenditure of a few dollars. The comb stripper illustrated herewith can be of any desired size ranging from 1 foot to 10 feet in width, depending on the quantity of seed to be gathered. The handswung strippers are usually about 1 foot wide with the teeth 10 inches long. The particular stripper illustrated (1) is 3 1/2 feet wide. This is a convenient size where seed from 3 to 20 acres is gathered. The stripper 3 1/2 feet wide can easily be swung on the axle of the wheels taken from an old buggy, between the hind wheels of a buggy or even of a farm wagon.

This machine can be taken along any ordinary wagon road on its own wheels. If necessary, one man and a horse can operate the machine to good advantage, although a boy to assist in bagging the seed and clearing the teeth when they become choked up is advisable. The wider stripper may be swung between hayrake wheels or set up on wheels of iron or wood.

If these wheels be 18 inches or less in diameter, the stripper can be placed above the axle. It is necessary that the seed be fully ripe in order to strip easily, and it is also desirable that the ground be given level tillage in order to facilitate the operation of the stripper.

947 - Review of Patents.

Tillage Machines and Implements

Canada	179 820. Cultivator.
	177 210. Scraper for disc plough.
Denmark	22 257 -- 22 258. Motorecultivator with working parts.
France	482 155. Motorplough for vineyard cultivation.
United Kingdom	106 878. Harrow.
United States	1 232 025. Rotating ploughing wheel for motor plough.
	1 232 240. Wheel-adjusting mechanism for wheeled ploughs.
	1 232 380 -- 1 233 139. Harrows.
	1 232 420 -- 1 233 040 -- 1 233 136. Motorploughs.
	1 232 483 -- 1 232 661 -- 1 233 751. Ploughs.
	1 232 963. Riding attachment for drags.
	1 232 997. Plough with removable share.
	1 233 000. Cultivator.
	1 233 412. Tilling machine.
	1 233 734. Sulky plough.
	1 233 760. Agricultural implement.
	1 233 778. Subsoiler.
	1 234 002 -- 1 235 512. Cotton chopper.
	1 234 760 -- 1 234 761. Engine gang plough.
	1 235 176. Attachment to ploughs.

Drainage and Irrigation.

- 176 982 -- 177 183. **Sprinklers.**
 el States 1 232 029. **Drainage system.**
 1 232 838. **Ditching plough.**

Manure Distributors.

- el States 1 234 362. **Manure spreader.**
 1 234 528. **Fertilizer attachment for planting machines.**

Seeding and Planting Machines.

- 177 114. **Seeder mechanism.**
 22 236. **Potato planter.**
 el States 1 231 558. **Planter.**
 1 231 701. **Planter heel attachment.**
 1 232 288. **Land marker.**
 1 233 146. **Maize planter attachment.**
 1 233 167. **Attachment for checking maize without a wire.**
 1 233 205. **Cotton planter.**
 1 233 296 -- 1 234 592. **Maize planters.**
 1 233 375. **Grain drill.**
 1 234 372. **Disk grain-drill.**
 1 234 745. **Disk attachment for planters.**

Cultivators, etc.

- 107 257. **Thinning root-crops.**
 el States 1 232 149. **Rotary tool weeder.**
 1 232 188. **Garden implement.**
 1 233 121. **Cultivating implement.**
 1 233 580. **Adjustable cultivator.**
 1 233 731. **Attachment for maize cultivator.**
 1 234 453. **Roll weeder.**
 1 234 581. **Weed destroying machine.**

Control of Diseases and Pests of Plants.

- 64 646. **Insecticide treatment increasing the efficacy of sulphating.**
 75 746. **Mouse-trap with automatic shutter.**
 el States 1 231 877 -- 1 232 762. **Insect-traps.**
 1 232 670 -- 1 235 473. **Boll weevil catcher.**
 1 235 302. **Weed and seed destroyer.**

Reapers, Mowers and Other Harvesting Machines.

- 176 010. **Maize harvester.**
 177 117. **Grain shocker.**
 el Kingdom 106 015. **Sharpening reaper, etc., knives.**
 el States 1 231 600. **Attachment for grain binders.**
 1 232 226. **Harvester elevator.**
 1 232 652 -- 1 232 854 -- 1 233 055 -- 1 234 503. **Grain shockers.**
 1 232 681. **Binder attachment.**
 1 233 174. **Harvesting machine.**
 1 233 303 -- 1 233 418. **Maize harvesters.**
 1 233 907. **Cotton picker.**

- 1 231 950. Sickle-bar.
1 234 528. Mowing machine.

Machines for Lifting Root-Crops.

- Denmark 22 103 — 22 314. Root toppers and harvesters.
United Kingdom 107 066. Digging root crops.
United States 1 231 593 — 1 231 836 — 1 232 086. Beet harvesters.
1 231 837 — 1 235 190. Beet toppers.
1 233 805. Peanut harvester.

Threshing and Winnowing Machines.

- Canada 177 169. Grain cleaner.
177 276. Grain elevator.
United States 1 231 951. Cotton-seed linter.
1 232 064. Bean and pea hulling machine.
1 232 195. Extension feeder for grain threshers or separators.
1 232 947. Screening mechanism for threshing machines.
1 234 168. Threshing machine.

Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.

- Denmark 22 222. Boxes for conveyance of fruits, etc.
Spain 64 769. Machine for separating the kernel from the shell.
Switzerland 75 628. Green fodder press.
75 742. Silo for maize ensilage and installation device.
United Kingdom 107 397. Hay-bogies.
United States 1 232 251. Fruit press.
1 232 270. Banana heater and ripener.
1 232 271. Method of preserving fruits and vegetables fresh.
1 233 038. Hay stacker.
1 233 398. Ensilage elevator.
1 234 978. Hay press.
1 234 363 — 1 234 364. Grain stackers.
1 235 044. Hay baling press.

Lorestry.

- Canada 177 168. Machine for filing sawteeth.
177 388. Tree sawing machine.

Steering and Traction of Agricultural Machinery.

- France 483 558. Improvements to agricultural tractors and their hitches and tilling implements.
483 559. Improvements to agricultural tractors and cultivating implements for special use in vineyards and in horticulture.
Switzerland 75 627. Driving device for agricultural machines of various kinds.
United Kingdom 107 097. Motor tractors.
United States 1 232 222. Sleigh attachment for vehicles.
1 232 245. Hitching device for tractors.
1 232 399. Gearing for tractors.
1 232 620 — 1 234 145 — 1 234 148 — 1 234 437 — 1 234 600 — 1 235 125. Tractors.

- 1 232 635. Tractor wheel.
 1 233 549. Clevis.
 1 234 813. Vehicle running gear.
 1 234 863. Transmission gearing for motor agricultural machines.

Feeding and Housing of Livestock.

- ank 22 249. Halter for cows.
 1 Kingdom 106 771. Harness.
 106 801. Horse and like collars.
 106 889. Machine for making horse shoes.
 1 States 1 232 092. Apparatus for checking runaway horses.
 1 233 869. Horseshoe.
 1 234 054. Feeder.
 1 234 349. Self feeder for alfalfa hay for hogs.

Aviculture.

- eland 75 744. Electrical incubator.
 1 States 1 232 868. Incubator.
 1 233 793. Chicken vermin trap.

Fisheries.

- 1 63 597. Set of fishhooks.
 eland 75 639. Artificial bait.

Industries Depending on Plant Products.

- 1 61 724. Process for making cork shavings agglomerates.
 64 758. Grain, etc., grinding machine.
 64 762. Defibrating machine.
 1 Kingdom 107 218. Bread making process.

Dairying.

- 1 177 932. Milking machine.
 177 150. Dash churn.
 177 341. Cream comminuting process.
 eland 75 682. Device for making butter.
 1 States 1 231 806. Milk aerator.
 1 232 181. Churn.
 1 232 568. Regulating device for centrifugal cream separators.
 1 232 810. Suspension and driving device for centrifugal cream separator
 bowls.
 1 232 811. Centrifugal cream separator.
 1 233 494. Indicator for milk bottles.
 1 233 446. Dried milk and method for producing the same.
 1 233 608. Milking machine.

Farm Buildings.

- eland 75 743. Stable floor.
 1 States 1 232 388. Silo-roof.
 1 232 604. Silo.
 1 233 719. Gate.

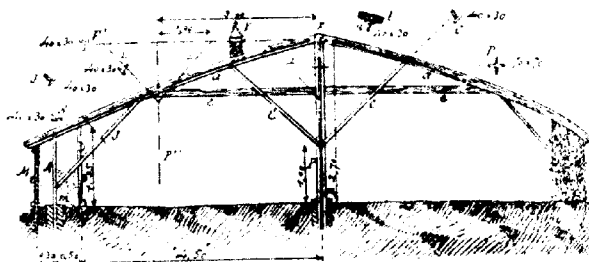
948 - **A Potato Storehouse.** — I. RINGELMANN, MAX, in *Journal d'Agriculture pratique*, Year 81, Vol. 30, No. 5, p. 91, 1 fig. Paris, March 8, 1917. — II. KROTOFF, M., in *Bulletin l'Union des Agriculteurs d'Egypte*, Year 15, No. 120, pp. 83-87, 1 fig. Cairo, June-July 1917.

I. — A storehouse used on a farm at Loir-et-Cher, France, is described as suitable for storing the potato crop from about 74 acres to be used for the manufacture of starch.

The appended figure shows the details of the building, which is very simple. The potatoes always kept very well in it.

Each truss, 10 metres long, is supported by two posts *A* of plain T-iron and one centre post *P* of crossed iron (the dimensions of the irons are given in mm. on the figure). The rafters *a*, slightly curved, are reinforced by struts *I* and *C*. All the parts, except the centre post *P*, are of plain T-iron, bolted together.

On the straining-sill of the rafters *a* is a board *b* laid flat and bolted at intervals to the iron *a*; the board *b* receives the battens. The po



Potato Storehouse: transverse section.

A and *P* are fixed into brick beds. The ridge, whose projection is shown by the dotted line *FF'*, is supported by straps *L* bolted to the posts *P*. Between each truss (3 metres apart) is placed a small, plain, wooden tie made of two pieces of wood, similar to those used for *b*, forming false ribs joined by a tie beam *c*, placed edgewise, the two extremities of which are nailed to the false rafters. The wood battens are tongued and grooved, being placed horizontally on the trusses without purlins or spars. The boards are oiled, and covered with tarred felt.

The walls of the long side *M* and those of one of the gables are made of a framework 0.80 metres thick, filled with sand held by a vertical branch wickerwork, supported by horizontal stakes. The floor of the store is slightly raised, and drained by the ditches outside, from which the earth for the wall *M* was taken. Wooden ventilators *V* are placed in the roof. During very cold weather the potatoes are covered with straw.

II. — In Egypt the chief difficulty to be overcome is the damp heat. Care must be taken to store only ripe, dry and healthy potatoes, and to

when the temperature is lowest, that is to say, between 2 or 3 in the morning sunrise. A floor which may be highly recommended consists of a slatted floor made of laths or other material, so that there shall be a space of between 15 to 20 cm. between the heap and the group.

A store to hold 15 to 20 tons of potatoes should cover an area of about square metres (8 m. \times 5 m.). If 1 metre be left for the passage, about 17 planks 5 \times 15 cm. thick and 4 metres long should be laid down at regular intervals of about 50 cm. On top are placed perpendicularly rather thick laths 20 to 30 cm. wide with the same space between them; a only need be fixed to the planks with small nails.

The passage is formed by a wooden partition 1 metre high. The planks be replaced by bricks one on top of the other, and the laths by any kind of wood as long as there is a free space of 15 to 20 cm. underneath, and not with an equal number of open and closed spaces. A minimum of from 20 to 500 kg. may be stored per square metre.

- **Designs for Dipping Baths for Sheep, in U. S. A.** — See No. 625 of this *Review* (with illustrations).

RURAL ECONOMICS.

- **Farm Management Investigations in the United States.** — Report of the Committee on Investigations of the American Farm Management Association in Record of the Proceedings of the Seventh Annual Meeting of the American Farm Management Association, pp. 58-67, Washington D. C., 1917.

This report of the Committee on Investigations of the American Farm Management Association presented at the seventh annual meeting of the association held in Washington D. C., November 13-14, 1916, is designed to show the scope of investigation work in farm management now under way throughout the entire United States.

The data secured by the members of the Committee are presented under the following headings:

- A. State institutions from which no reports were received.
- B. State institutions reporting no work of a farm management nature.
- C. Condensed statement of farm management work at State institutions.
- D. Condensed statement of farm management work of Federal departments.
- E. List of subjects suggested for investigation (and name of suggestion).
- F. Detailed description of farm management work reported for State institutions.
- G. Detailed description of farm management work reported for Federal departments.

An outline of the Farm Management Work reported for the office of Farm Management, U. S. Department of Agriculture, is here given:

Farm Management Work reported for the Office of Farm Management U. S. Department of Agriculture, May 1916.

1. Beet Sugar. Cost of growing sugar beets. Object, to investigate farm practice in the production, and report, cost of production, profitability of the enterprise, and geographic and

economic conditions making the crop desirable (1910) (1). — *Location*: Important sugar-beet districts of Michigan, Ohio, Colorado, Utah, Idaho, Montana and California. *Method*: Modification of farm management survey. *Findings*: — During past two years 1314 entries records obtained in several areas; these now summarized and results being compiled. Additional data obtained during the summer of 1916.

2) *Project*. — Cost of producing hay and grasses: *Object*, same as preceding (1). Done with crew management in making hay, etc. (1910). — *Location*: Important hay-producing States. *Method*. — Same as preceding. *Findings*. — Data on cost of production obtained in New York, Pennsylvania, Iowa, Nebraska, Kansas and Oklahoma.

3) *Project*. — Cost of growing potatoes: *Object*, same as preceding (1911). — *Location*: Important potato growing districts in 19 States, Maine to California. — *Method*: Same as preceding. — *Findings*: Nearly 900 cost records obtained and compiled.

4) *Project*. — Cost of producing cotton: *Object*, same as preceding (1913). — *Location*: Important cotton growing districts. — *Method*: Farm management survey and methods thereof. — *Findings*: Compilation of several hundred records.

5) *Project*. — Cost of producing corn silage: *Object*, same as preceding, including capacity of silos, shrinkage, etc. (1915). — *Location*: Important silage growing districts in New York, Pennsylvania, Iowa, Nebraska, Kansas and Oklahoma. — *Method*: Modification of farm management survey; cost records kept in cooperation with farmers and Experiment Stations. — *Findings*: Several hundred records from these interviews; studies have given certain records covering long periods; weighings made to determine silo capacity and shrinkage.

6) *Project*. — Cost of fruit production: *Object*, same as preceding (1912). — *Location*: Important fruit-growing districts in the United States. — *Method*: Modification of farm management survey; cost records of apple production on New York farms, in cooperation with Bureau of Plant Industry. — *Findings*: Nearly 1000 records taken on apple production.

7) *Project*. — Economics of farm woodlots: *Object*, data over wide range to ascertain relative importance (1915). — *Location*: Sixteen typical sections, 50 to 75 farms each. — *Method*: Farm management survey in general; woodlots inspected in cooperation with Forest Service.

8) *Project*. — Cost of producing feeder cattle: *Object*, to determine cost under different conditions with reference to the farm as a whole. Includes maintenance of breeding herd (1914). — *Location*: Important stock-producing regions. — *Method*: Modification of farm management survey; cooperation with Bureau of Animal Industry. — *Findings*: Several hundred records from Central West; studies to be continued in other livestock regions.

9) *Project*. — Cost of finishing beef cattle: *Object*, to determine cost in relation to profitability of farm business (1914). — *Location*: Same as preceding. — *Findings*: Incomplete.

10) *Project*. — Cost of producing baby beef: *Object* (3), to determine cost under different conditions; complete data of breeding herds obtained; special attention to determine factors that make it desirable (1914). — *Location*: Same as preceding. — *Method*: Same as preceding. — *Findings*: published.

11) *Project*. — Cost of producing dairy cattle: *Object*, same as under finishing beef (1906). — *Location*: Farms where calf-production is important. — *Method*: Cost record in cooperation with farmers and Experiment Stations in New York, Ohio, Wisconsin and Minnesota. — *Findings*: Incomplete.

(1) The date given in parentheses immediately after the statement of each project throughout this entire list refers to the time the project was begun.

(2) Wherever the statement "Object, same as preceding" appears in this list: the heading "project", reference is made to practice in production, equipment, cost of production, profitability of enterprise and the geographic and economic conditions which render the crops desirable as a part of the farm business.

(3) See R., August 1917, No. 743.

- 2) *Project*. — Cost of producing dairy products with relation to the profits of the farm business (1908). — *Location*: Thus far only individual farms and in regions where farm management surveys have been made. — *Method*: a) Farm management survey; b) detailed cost accounts in cooperation with farmers and Experiment Stations. — *Findings*: Records from several series of years compiled and submitted for publication; studies made on over 100 dairy farms in Pennsylvania, Michigan, and Wisconsin.
- 3) *Project*. — Cost of raising costs and maintenance of farm work horses (1916). — *Location*: Regions where horse labour is important. — *Method*: Cost accounts in cooperation with Experiment Stations in New York, Wisconsin and Minnesota. — *Findings*: Incomplete; some cost records compiled.
- 4) *Project*. — Relation of farm practice to crop yield (1912). — *Location*: All sections of the United States. — *Method*: Modification of farm management survey. — *Findings*: About 100 farms studied with reference to use of manure and fertilizers.
- 5) *Project*. — History and distribution of farm enterprises. *Object*, to determine geographic regions which have directed the development of American agriculture (1912). — *Location*: United States. — *Method*: Compilation of available geographic and historical data, and relation with agricultural practices and farm management experience; in cooperation with the office and various bureaux of the Department of Agriculture. — *Findings*: Maps and reports prepared for Atlas of American Agriculture, also supplementary Atlas relative to the culture of the world.
- 6) *Project*. — Farm management surveys, comprehensive analysis of farm business (1909). — *Location*: Surveys made in eight regions and various small areas. — *Method*: Farm management survey; personal interviews with farmers. — *Findings*: Published.
- 7) *Project*. — Cost of farmer's living; what farm contributes, etc. (1914). — *Location*: Selected areas in various States. — *Method*: Modification of farm management survey.
- 8) *Project*. — Farm tenantry; to determine principles, systems, lease contracts, etc. (1906). — *Method*: Farm management survey; cooperation with Iowa State College. — *Findings*: Incomplete.
- 9) *Project*. — Farm Equipment: *Object*, To determine economics of, character, cost and use in relation to farms of different types and sizes (1906). — *Location*: General; selected for specific problems. — *Method*: a) Modification of farm management survey; b) by clerks or interviews. Some cooperation with Bureau of Plant Industry. — *Findings*: Incomplete.
- 10) *Project*. — Cost and efficiency factors in greenhouse heating (special) (1913). — *Location*: In every State. — *Method*: Data obtained from greenhouses directly and by questionnaires. *Findings*: Numerous factors appear to have bearing on fuel consumption in greenhouses, as repair of houses, sizes of boilers, grate area, etc.
- 11) *Project*. — Farm Equipment (special), use of milking machines on dairy farms (July 1915-July 1916). — *Location*: Dairy sections of New York, Michigan and Illinois. — *Method*: Modification of farm management survey. — *Findings*: Mechanical milkers aid in efficient organization of dairy farms.
- 12) *Project*. — Farm Equipment (special), cost of fencing in North Central States (1911-1916). — *Location*: Twelve North Central States. — *Method*: Personal interviews and use of questionnaires. — *Findings*: Published.
- 13) *Project*. — Farm Accounts: practical methods of farm bookkeeping and accounting (1906). — *Location*: General. — *Method*: Studying existing systems; records kept in cooperation with Experiment Stations. — *Findings*: Progress made in determining and clarifying the underlying subject of farm accounts.
- 14) *Project*. — Weeds and tillage in relation to farm management (1902). — *Location*: All sections of the United States. — *Method*: chiefly by reconnaissance survey; field experiments in cooperation with farmers and Experiment Stations. — *Findings*: Methods of controlling weeds; catalogue describing 100 of such weeds.

25) *Project*. — Clearing and use of logged-off lands (1908). — *Location*: cut-over lands of the United States. — *Method*: Farm survey to an extent. — *Findings*: Published.

26) *Project*. — Application of farm economics to farm practice: *Object*, to interpret economic conditions prevailing in each agricultural region; to correlate data collected by various agencies of the Department and State institutions; and to utilize such data to develop systems of farm organization and operation adapted to various types and sizes of farms prevailing and should prevail in different sections of the country. — *Location*: The United States, divided into geographical sections. — *Method*: Data obtained by analytical studies of farm business; special studies of different enterprises and general farm practice in each region; cooperation of State Agricultural Colleges, Experiment Stations, States Relations Service and individual farmers. — *Findings*. Results reported separately for each region.

Subproject. — Farm organization in Northeastern region. — *Findings*: Farm analyses of 1800 New England farms (1914-1915) and extensive records obtained; also 600 records in Chester County Pa. Organization studies on several individual farms. Three hundred and fifty truck-farm records from Gloucester and Mercer counties N. J., during two successive years.

Subproject. — Farm organization in North Central States. — *Findings*: Analyses of 800 farms in northern cut-over districts compiled; progress made on farming systems for districts; special study of management of sandy farms in northern Indiana and southern Michigan.

Subproject. — Farm organization in Middle Atlantic and Appalachian region. — *Findings*: Progress in working out systems of farming for this region.

Subproject. — Farm organization in the cotton belt. — *Findings*: Analyses of entire business, crop and stock costs on several hundred farms in cotton States and results in manuscript ready for publication.

Subproject. — Farm organization in the corn belt. — *Findings*: Progress in development of better farming systems - more efficient use of labour, more livestock, more profit.

Subproject. — Farm organization in Middle West plains region. — *Findings*: Farm organization work not yet fully outlined, and only primary results available.

Subproject. — Farm Organization in Rocky Mountain and Pacific region. — *Findings*: Results of studies in Palouse country, Washington; in Oregon and in Arizona and Utah Valley prepared for publication; similar work in Montana. Systems of bean, forage crops and farming studied. Over 1500 farm analyses used as basis.

Project. — Special agricultural problems in the Rocky Mountain and Pacific region: — *Location*: Limited areas in Rocky Mountain and Pacific regions. — *Method*: Farm Management survey to an extent; study of all economic features. — *Findings*: Immense amount of data collected relating to development of irrigated areas and economics of ranching for production in near future.

A condensed statement of Farm Management Work at State Institutions (Agricultural Experiment Stations) follows:

Farm Management Work at State Institutions

Arizona. Farm management survey of the sugar and ostrich industries in the Salt Valley.

California. Investigation into the financial side of farming as applied to the production of fruit, field, cereal and other crops of a similar nature. Investigations into the financial side of farming as applied to the production of beef, swine, poultry, sheep and other kinds of stock as applied to California. Justification of the acre or "handkerchief" farm as typified by the "Little Landers" idea. Capital required by California farmers going into diversified farming.

Colorado. Farm management surveys in selected dry land districts.

Illinois. Cost accounting on dairy farms. Cost accounting in connection with fruit and orchardists. Systems of live stock farming studies by cost accounting.

- Indiana.* Cost of producing crops in Indiana.
- Iowa.* Farm management survey of Black Hawk, Tama, Grundy and Warren Counties. Farm management survey of scattered farms in several counties of the state.
- Kansas.* Completed records of the farm business as shown by complete cost accounts. Farming conditions and factors affecting them by the Farm Management Survey of 1901.
- Kentucky.* Detailed farm management survey for the purpose of permanent modification of the law in the dark tobacco district.
- Minnesota.* Cost of producing farm products in Minnesota. Studies of the business of farming in Minnesota through the farm survey method.
- Mississippi.* Determination by cost accounting of the relative profits in dairying, beef raising, cotton and diversified farming in Mississippi. Determination of the relative general incomes on cotton, dairying and diversified farms in Mississippi.
- Missouri.* Farm cost accounting. Farm management survey made in Johnson county. Family living on the farm. Distribution of Farm Labour. Animal units and feeding practice on the corn belt.
- Montana.* A farm management survey in the Gallatin Valley. Farm cost accounting. An all-terrain survey in the Billings Sugar-Beet Region. A wheat enterprise survey. A sugar enterprise survey.
- Nebraska.* The effect of climate and soil upon agriculture. Type of farming most profitable in Nebraska. Farm management survey. Selling apples and potatoes from box cars direct to consumer.
- New Hampshire.* A corn production survey. Farm management surveys.
- New Jersey.* Profits from potatoes as a specialized type of farming. General farming as a type of profits in New Jersey. Profits from a specialized type of dairying. Profits from truck raising.
- New York (Cornell).* The study of farm management.
- North Dakota.* Seasonal distribution of labour. Cost of producing agricultural commodities in Dakota. Farm record investigations. Assembly and study of farm practice methods. (Cornell State University). Cost accounting investigations on fifteen typical Ohio farms. Measuring land in Ohio.
- Ohio.* Experiment Station. Statistical Studies: A study of the increase and decrease of the yields of crops, and the reasons there for, in the various counties of the state; same as stock. Rotations: A study of the gross and net receipts from different rotations, the action of labour involved, the effect on the yields and on the physical and chemical characters of the soil. -- Types of farming: A study of the types of farming in vogue in a given county, the fundamental reasons therefor and changes that may be desirable; the effect of these upon the land and upon the man. -- Successful and unsuccessful farms: The study of the working of the farm management and farm practice methods in use on successful and small farms. -- Small farms: A study of the types of farming adopted to small farms in sections of the state. -- Pastures: A study of incomes from pastures and as compared with other lands. -- Permanent improvement: A study of the character and cost of permanent improvements including fences, buildings and tile drainage. -- Farm equipment: study character and cost of farm machinery and tools. -- Miscellaneous: Reification of the farmstead. Systems of farming as affected by markets and roads. Cost accounting, agricultural lime. Cost of tile drainage.
- North Carolina.* Agricultural survey in the Greenboro Valley. Agricultural survey on 25 farms in Preston and the same number in Brooke county. A social and economic survey of 100 farms. An agricultural survey of selected farms in Preston County.
- Ohio.* Farm management surveys and demonstrations cost accounting. Study of farm history. Tenancy and labour problems. Marketing of Wisconsin butter. Market-making.

- 951 - **Farming in the Bluegrass Region** (A Study of the Organization and Management of 178 Farms in Central Kentucky).--ARNOLD, J. H. and MONTGOMERY, FRANK, JR. *Department of Agriculture Bulletin No. 482* (Office of Farm Management), pp. 1-32. Washington, D. C., February 19, 1917.

The purpose of this bulletin is to present a general description of the farm-management practices followed in the bluegrass region of Kentucky and to determine from analyses of the operations on about 200 such farms the relative efficiency of the different types of farming in vogue and the factors which seem to have the greatest influence on farm profits in the region.

It was found that specialized farms, those of the tobacco, stock, dairy type, moderately diversified, are the most efficient in this region, and that the general mixed farms, more highly diversified, are the least efficient.

Thus, while diversity has a vital relation to profits here as elsewhere it would appear that in the bluegrass region these specialized farms have found in moderate diversity the right degree for maximum profits.

Of the factors which determine profits, size of business was found to have the greatest weight, with utilization of pasture and yield of field crop per acre important secondary factors. Size of farm has here no direct bearing upon labour income. It does, however, determine the character of the farm organization, the small farms naturally turning more to the cultivation of tobacco and the large farms to grazing.

The analytical data collected with this survey, which have led to the conclusions mentioned, are presented in XXI Tables and discussed in the following order: method of study; general description of the region; history of bluegrass farm enterprises; rotation of crops; soil; climatic seasonal distribution of operations; labour and power units required; land tenure and cropper labour; importance of size of farm; types of farms; relation of type of farm to efficiency, to utilization of pasture, to yields; relation of diversity to profitable farming; cost of production; prime factors in profitable farming.

952. -- **Investigations into Cost and Methods of Clearing Land**. -- See No. 947 in this Review.

AGRICULTURAL INDUSTRIES.

- 953 - **A Comparison of Several Classes of American Wheats and a Consideration of Some Factors Influencing Quality**. -- THOMAS, L. M., in *U. S. Department of Agriculture, Bulletin No. 557*, pp. 1-27. Washington, D. C., May 18, 1917.

The investigations reported in this Bulletin were made in the Office of Grain Standardisation of the Bureau of Plant Industry in cooperation with the Office of Markets and Rural Organization, in connection with enforcement of the United States Grain Standards Act. The fitness of several types of wheat for the manufacture of white flour and the adaptation of the flour from these several types to the manufacture of different kinds of bread products were studied, in view of a division of wheat

distinctly different character into general classes. A comparative valuation of the wheat within any one class was also made.

In all, five distinct classes of wheats, grown in various sections of the United States, have been studied :

1) Soft red winter wheat, or "red winter", as it is better known on the market, is the principal class of wheat grown in sections east of the Mississippi River, in the State of Missouri, and in parts of the States joining the west and south.

2) Hard red winter wheat is grown chiefly in Nebraska, Kansas, and parts of Oklahoma and Montana, although small quantities are grown in the adjoining States.

3) Hard red spring wheat is grown in North Dakota, Minnesota, and parts of Dakota and Montana. This wheat is more generally known commercially as northern spring wheat.

4) Durum wheat is grown in about the same territory as hard red spring wheat and to a limited extent in the southern great Plains area and Intermountain and Pacific Coast States.

5) White wheats are grown to a comparatively small extent in some of the Eastern States and more generally in the Intermountain and Pacific Coast States. Only a limited amount of work was done on this class of wheats, and in this report reference is made only to some factors relating to the quality of the flour produced from them. There are other classes of wheats, particularly the western red wheats, both spring and autumn wheat, of which no mention is made in this bulletin.

A partial survey of the results of this work is presented in the following summary.

1) Normal, plump, dry and sound wheat of all classes yields approximately the same percentage of flour. Over 80 per cent. of the samples of each of the three classes of the more common wheats, soft and red winter and hard red spring, yielded between 67 and 75 per cent. flour.

2) There is direct relation between milling yield and the moisture content of wheat, and in a general way the yield varies inversely with moisture content. Were it possible to eliminate other factors, such as variation in plumpness of the kernels, it is probable that this relationship would be more apparent.

3) The weight per 1 000 kernels or average weight of kernels, has very little value in judging the potential flour yield.

4) Although there are frequent exceptions when individual samples are considered, average results show a very striking relation between weight of bushel and flour yield, the latter varying directly with the former. The relation between these two figures, however, is not quite the same for the different classes nor is it the same for all varieties within each class.

5) In colour the bread from the flour of the various classes of common wheat shows about the same ranges and averages. The flour from durum wheat is considerably more creamy and thus averages several points lower in that of any other class.

6) Bread from all normal durum samples has a tint or colouration

varying from slightly creamy to bright yellow, while, of the hard red winter samples, 77.6 per cent. show a noticeable creamy tint, of the hard red spring samples 69.5 per cent, and of the soft red winter samples only 18.9 per cent.

7) The general results indicate that test weight and soundness when considered together, are of far more value in appraising quality than when either is considered by itself.

8) Small amounts of inseparable material are generally accompanied by a decrease in flour yield, as would be expected, since, as a rule a large part of such material usually finds its way into the bran and shorts.

9) Loaf volume and texture are the two factors which are considered as indicative of strength. While a great range of strength was found within each class of wheat, the averages for each class show considerable differences between the various classes when considered as a whole. Given in order from weakest to strongest the classes are soft white, soft red winter durum, hard red winter, and hard red spring wheat.

10) The average loaf volume in cubic centimeters for each of the classes is soft white wheat, 1 909; soft red winter, 1 965; durum, 2 097; hard red winter, 2 219; and hard red spring 2 421. In the matter of texture the several classes stand in the same order, except that soft red winter has a slight advantage over durum wheat.

11) Of the four more important classes of wheat under consideration durum is the highest in crude-protein content; hard red spring, second; hard red winter, third; and soft red winter, fourth.

12) High crude-protein content as a rule is accompanied by high strength, but the relation between these two factors varies with the different classes of wheat, and extremely high crude-protein content is sometimes accompanied by a decrease in baking strength.

13) The average water absorption of the flour from durum and from hard red spring wheat is about the same and that of hard red winter is only slightly lower.

The water absorption of the soft wheats averages from 3 to 4 per cent lower than for the hard wheats. The range of water absorption of each class varies within wide limits.

14) There is a direct relation between the water absorption of the flour and the bread yield of a unit quantity of the same. As a rule, the higher the absorption the greater the weight of the loaf.

954 - **The Utilisation of the Horse-Chestnut.** — GORIS, A., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 165, No. 10, pp. 345-348, Paris, September 3, 1917.

In the course of previous work on the composition of the horse-chestnut (*Aesculus Hippocastanum* L.), the author had considered the possibility of making use of the different parts of this tree. The present paper leaves completely aside everything connected with the utilisation of the wood of the bark, and only takes into account the importance of the fruit as a food.

The horse-chestnut is a seed enclosed in a tegument of well-known colour; it is composed of two cotyledons, closely joined, and a radicle fitting into a cavity in the seed. There is no albumen.

The tegument contains aesculin and a special tannin: aesculitannic.

It is of no economic value, and, on the contrary, it makes treatment of the seed difficult. When fresh it can be removed fairly easily, but, in the dried seed, it adheres closely to the cotyledon; it makes crushing difficult and bits of it are found mingled with the meal.

The dry cotyledon contains:

Fatty matter	2 to 3 %
Nitrogen	6 to 7 %
Starch	20 to 30 %

bitter substances of the saponin group and colouring matter. Neither aesculin nor tannin are found; these belong exclusively to the tegument.

The oil is not of great interest. It is present in too small a proportion to justify extraction for commercial purposes; moreover it is very difficult to extract from the fresh chestnut. As a result of the saponin it contains, it forms such a cohesive mass that the ordinary fat solvents do not dissolve it.

The only commercial interest the saponins have is as a lather-producing substance. If necessary they can be isolated from the *fresh* chestnut. During fermentation or fermentation these substances undergo considerable change, but, however, disappearing altogether, and treatment with solvents becomes possible.

From another point of view these saponins have an intense physiological action, which gives the medical preparations made from them their therapeutic action in congestion of the venous system (haemorrhoids, varix, piles, broken-wind in horses). It is especially these pharmaceutical properties, and their bitterness, which prevent the utilisation of the chestnut.

It is, therefore, impossible to use the pulp or the flour without previously removing these substances, and various methods of doing this have been recommended: exhaustion with alcohol (BAUMÉ), washing with pure water (MENTIER, BAUMÉ), washing with alkaline water (POTTIER, FLANDIN), washing with acid water (VERGNAUD-ROMAGNÉSI).

In his experiments the author gave preference to washing with acid water. He used 1/1000 hydrochloric water, but it is obvious that other acids will serve the same purpose.

This treatment is quicker than with pure water, less expensive than the use of alcohol, and gives a whiter flour than washing with alkaline water. By this method 20 to 25 % of a fine, white flour, having neither colour nor taste, may be obtained in the laboratory. The starch particles are regular, some small, round or oval, others large, pyriform or elliptical, with a linear or star-shaped hilum clearly visible in the largest part of the cells; striae barely visible.

It is possible to ascertain whether the saponins have been removed from the washing water by looking for either their biological properties

(haemolysis of red corpuscles), or their physiological properties (stupifying action on fish).

This flour might be used for the preparation of alcohol or even as food. The Museum of the Pharmaceutical School possesses foodstuffs prepared with it. Moreover, there were at one time, near Paris, starch factories for horse-chestnuts (De Callias). They failed for the economic reasons given above.

The residue from the extraction of starch, the cake, after treatment is also free from bitterness; it might very possibly be used as a food for cattle.

955 - **Observations and Experiments on the Manufacture of Tea at Java.** — by J. J. B., in *Mededeelingen van het Proefstation voor Thee*, No. LII, Semarang, 1901.

The temperature of tea-leaves during fermentation was studied in about 30 factories in plantations situated in different districts, varying greatly as regards climatic conditions.

It was possible to divide the results into four groups, according to the position of the factory, and the conditions of temperature and moisture. These results show that a knowledge of the climatic conditions will allow the previous determination of the progress and duration of fermentation of tea leaves.

It is unnecessary to keep the mass of fermenting leaves at a temperature below 26° C, because leaves which pass through the roller previous to fermentation reach a temperature much above 26° C.

Some factories stir the mass of fermenting leaves; this method seems to dry the leaves too quickly and to interrupt fermentation. Desiccation amounting to as much as 10-15% was found, and this must certainly hinder the regular progress of fermentation.

Attention is drawn to the necessity of keeping a sufficient degree of moisture in the sheds where fermentation is carried out. In factories built up in the mountains it may even be necessary at times to heat the sheds in order to hasten fermentation.

In order to regulate fermentation it is advisable to sort the leaves previously according to size and quality. By the present method the leaves are sorted after fermentation and drying.

A heap of fermenting leaves should not be more than 4 cm. thick and the temperature should be kept at 25° C. at the lowest.

The author made experiments on drying with quick lime, but results were far from satisfactory. Drying *in vacuo* also gave unsatisfactory results. Experiments show that drying at a low temperature is detrimental to the quality of the tea, and that the usual method of drying with air is preferable.

Further remarks on the drying of tea are given in another chapter.

The Carbone Method for Retting Textile Plants by Microbiological Action.

— I. CARBONE, DOMENICO, Sopra un bacillo macerante aerobico, in *Annali d'Igiene sperimentale*, Vol. XXVI, Pt. 1, pp. 57 + 11 plates. Rome, 1916. — II. CARBONE, DOMENICO, Sulla macerazione rustica della canapa: Prima nota, in *Le Stazioni Sperimentali agrarie italiane*, Vol. IV, pp. 261-299. Modena, 1917. — III. TOMBOLATO, ARTURO, Il metodo Carbone per la macerazione microbiologica delle tessili e la sua importanza pratica. Abstracted from: *I Progressi nelle Industrie Tintorie e Tessili*, Bergamo, 1917.

Many microbiological, as well as chemical, methods have recently been proposed for the industrial retting of textile plants. The first methods, besides being less expensive to install and work, also give a better quality of retted hemp than the latter methods. Prof. GIACOMO ROSSI's (1) method for the industrial retting of textile plants by microbiological action is the most important. The method is based on the passage of air through the macerating pits, which had already been proposed by MARMIER (1901) as a means of regulating and completing retting caused by special pectic aerobic ferments, and on the use of cultures of a spore-bearing bacillus, *Bacillus Cori* Rossi, which, according to Dr. CARBONE is identical with, or very similar to, *Bacillus asterosporus* Myer-Migula. This method, tested widely in Italy and in France, gave *satisfactory* results, for it shortens the time of retting, gives no bad smell, and allows even bad quality hemp to be retted more rapidly than in field retting-pools. To these advantages must be added the fact that the Rossi method applied to hemp gives a type of retting which differs from that obtained by the field methods; the green parts of the retted bark remain adherent to the fibres, and, in order to separate and whiten the fibre after retting, special machines must be used for washing it with water. Moreover, the harl obtained by Rossi's method is rather different from that obtained in the field pits, on which the market price is based; for the moment at least, then, there will be difficulty in disposing of the first type. The drawbacks may be attributed to the fact that the aerobic pectic ferment used by Prof. Rossi is not included in the native flora of the field pits (it was isolated from a decomposing potato).

It is for this reason that Dr. CARBONE, considering it necessary first of all to search for "retting agents such as are used in the fields so as to be able to use the knowledge thus gained of their biological requirements for covering the best means of favouring the victory of useful factors on useless or deleterious ones", isolated from the mud of some of the Bologna retting pits an obligate anaerobic bacillus, which he called *Bacillus felsineus*, and which is capable of retting hemp and many other textile plants.

Dr. CARBONE and M. TOMBOLATO have successively isolated this bacillus from the mud of pits in the province of Bologna, from the mud of pits of Rovigo, and from certain retting products of the province of Poles, and it seems highly probable that *B. felsineus* is the active species in the Italian hemp-pits.

This bacillus, together with the *Saccharomyces*, actively rets hemp stalks or green harl, in less than 2½ days at a temperature of 37° C.

(1) See the original article: — Prof. GIACOMO ROSSI, *Industrial Retting of Textile Plants by Microbiological Action*, in *R.*, August, 1916, pp. 1067-1075.

It gives the same type of retting as the field pits, i. e., complete detachment of the woody parts and its spontaneous exfoliation. This renders the use of special machines and washing unnecessary for obtaining a white hard fibre, the manual labour following on CARBONE's retting method is identical with that generally in use for the product of field retting. The CARBONE method is being extensively tested during the 1917 hemp season. To apply it is sufficient to build pools, heat the water to 37° C. by means of a current of steam or any other method, and use the desired ferment, which can be prepared at a minimum cost.

The experiments carried out by Dr. CARBONE up to the present show that, besides hemp, *B. jelsineus* is capable of retting flax, mulberry, ramie, nettle, broom, various Malvaceae, *Fourcraea*, *Sansevieria*, and various species of agave. This bacillus always gives a very rapid retting and very fine, white, well-separated fibres.

957 - Influence of Various Factors on the Quality of Rubber. — DE VRIES, O. I. Influence of rolling on crepe-rubber, in *Archief voor de Rubbercultuur in Nederlandsch-Indië*, Vol. No. 1, pp. 17-22. — II. Influence of the rubber content of latex on the quality of rubber, *Ibidem*, pp. 25-32. — III. Influence of the amount of acetic acid on the quality of the rubber, *Ibidem*, pp. 35-39. — IV. Influence of the age of the trees on the quality of rubber, *Ibidem*, No. 3, pp. 169-174. Batavia, 1917.

I. — INFLUENCE OF ROLLING ON CRÊPE-RUBBER. — The Author summarises as follows his own experiments, partly using those of Dr. N. J. SWART.

The opinion is still largely held that prolonged crepeing must be prejudicial to the coagulum. EATON and GRANTHAM had already stated in 1915 (*Agric. Bull. F. M. S.* III, 2) that the influence of crepeing, if any, is only small, while after these experiments had been finished, the results of CAMPBELL (*Bull. Depart. Agric. Ceylon* No. 21) became known. In crepeing as often as 50 to 70 times in the washing machine, no difference could be found in the vulcanised product.

The author repeated these investigations, first because the above mentioned investigators did not study the influence of smooth rollers, in which the rubber is most processed, further because no determinations of viscosity were mentioned, although a change in viscosity of the raw rubber would be the first thing to be expected.

The influence of crepeing can only be determined if the resulting pieces of crepe are of same thickness: difference in this respect may cause a difference in the rate of drying, and thus a difference in the rate of cure. This being allowed for, one would expect from prolonged crepeing a diminution of tensile strength and viscosity and a slower rate of cure. These expectations tend to show, in confirmation of the experiments of EATON, GRANTHAM and CAMPBELL, that often there is no difference at all, even with much longer crepeing than is ever practised, but in some cases small differences were found, though of no practical importance, and in one case, where the rubber became somewhat warm by prolonged treatment on smooth rollers, a marked diminution in viscosity found. Tearing and cutting of the fresh coagulum has to have little influence on its inner qualities; current opinion on this point is as a result of speculations on the "short or long fibre" of rubber. In actual estate practice, of course, crepeing as little as is consistent with a good outward appearance of the crepe means a saving in fuel and wear of machinery. Thin crepe, under present market conditions, has the advantage of rapid drying, though thick crepe with its rapid rate of cure might be preferred by the manufacturers. From our experiments the conclusion may be drawn that rolling a number of times more or less has no influence on the inner qualities of the rubber, provided enough

ed to keep the rubber and rolls cool. In trying to prepare crepe of uniform appearance and mass it does not matter if this is reached by passing the rubber a few times more or less over the rolls.

II. — INFLUENCE OF THE RUBBER CONTENT OF LATEX ON THE QUALITY OF THE RUBBER. — The Author gives the following summary of his experiments:

That the dilution of the latex would have an influence on the quality of the rubber obtained from it by coagulation was to be expected. Rubber, as a colloid, absorbs part of the serum substances in coagulating and retains them during the crepeing and washing process, and the more concentrated the latex, the more serum substances the rubber encloses and retains. Several experiments were made to determine what the influence of this factor may be in the process of rubber preparation. The results were:

- 1) The tensile strength showed no difference, though in some cases there were indications that a very diluted latex gave a lower tensile strength; further experiments will, however, be required to prove or disprove this.
- 2) The slope or type of the curve showed no difference.
- 3) The viscosity was diminished somewhat by dilution, but not to an important extent.
- 4) The rate of cure was diminished in an appreciable degree by dilution. The following summarises the differences for the two last named qualities:

Dilution of latex in per cent.	1st. Experiment		Dilution of latex	2nd. Experiment	
	Average Index of viscosity	Standard time of cure		Average Index of viscosity	Standard time of cure
11	1.71	145 min	6 %	1.70	150 min
10	1.76	about 135 "	9	1.71	145 "
11	1.77	130 "	12	1.74	about 140 "
20	1.78	125 "	14	1.74	140 "
31-8	1.79	120 "	17	1.715	155 "

The not unimportant difference in rate of cure makes it desirable to dilute the latex to a standard rubber content to obtain rubber of uniform quality.

In the preparation of smoked sheet a standard dilution is in general used; in Java, 15% dry or is mostly chosen as the dilution giving a coagulum that can be easily worked.

In the preparation of crepe, a standard dilution of latex is not generally accepted, but the mentioned facts show it to be desirable. It is to be remarked that undiluted latex gives the quickest curing rubber, but using undiluted latex in coagulation has the great disadvantage that on rainy days a product of variable quality is obtained.

It may be emphasised that a standard dilution of the latex is not only desirable with a view to obtaining a uniform product, but also for regular and economical work in the factory. In this is the only way to use acetic acid sparingly. When the rubber content of the latex is low, on some days more acetic acid than necessary is added, resulting in a loss; and on days not enough is used, giving a milky serum and loss of rubber.

III. — INFLUENCE OF THE AMOUNT OF ACETIC ACID ON THE QUALITY OF THE RUBBER. — Partly based on experiments of Dr. P. ARENS

and Dr. N. L. SWART, the Author summarises the results of his experiments as follows:

That the amount of acetic acid used in coagulation has no great influence on the inner qualities of the rubber, is already known from the results of other investigations. EXTON (*Ag. Bull. F. M. S. IV*, 165) signalled this as a distinct advantage of the use of acetic acid over other acids such as sulphuric. Several of the writer's experiments had been started before EXTON's results were published; he now reviews the results obtained, as they not only confirm, but also tend to amplify, the already known facts. The results may be summarized as follows:

- 1) For quantities of acetic acid ranging from the minimum to four times as much, the tensile strength of the rubber shows no difference.
- 2) The type of curve remained the same in all experiments in which the rubber was prepared as crepe; in one experiment with smoked sheet the type was slightly less when using double quantity of acetic acid, but this result will have to be checked by further experiments.
- 3) The rate of cure diminishes with increasing quantities of acetic acid, e. g. by 10 minutes in 1:35 when using four times the minimum. For double the quantity of acetic acid the difference is sometimes 5 minutes, but in several cases it was found to be negligible.
- 4) The viscosity decreases somewhat with increasing quantities of acetic acid, the difference not exceeding 0.10, however, even for four times the minimum amount, and often remaining near to within the limit of experimental error (0.20 to 0.03).

As in ordinary estate-practice great variations in the amount of acetic acid used for coagulation (e. g. half or double the ordinary quantity) will seldom or never occur, the use of acetic acid in practice will not form a factor causing important variation in the inner qualities of the rubber.

Economy in the use of chemicals of course necessitates the use of the minimum amount of acetic acid giving the desired coagulation within the desired time; but once this amount — which may differ for the method of preparation on different estates — is fixed, the small variations occurring in actual practice can not be the cause of lack of uniformity in the rubber.

IV. INFLUENCE OF THE AGE OF THE TREES ON THE QUALITY OF THE RUBBER. — Direct experiments to ascertain the influence of the age of the trees on the intrinsic properties of the rubber are practically impossible. In studying the qualities of rubber from the same group of trees over a long period, other factors in the cultivation, tapping system, planting distances, etc., nearly always vary, and in comparing rubber from different estates these same factors may play a — still unknown? — rôle; with rubber from different fields of the same estate, factors such as method of preparation may completely confuse the result, if, for instance, the latex is not every day reduced to a standard dilution. Old trees generally produce a latex of higher rubber content than young trees and, it has been shown in a previous communication (See above, § II) what an important influence the rubber content of the latex has, notably on the rate of cure of the rubber.

By means of several special experiments and by carefully selecting the material at hand the writer is now able to state, however, that under similar conditions as regards rubber content of latex, method of coagulation and preparation, etc., the properties are as follows:

- 1) The tensile strength for older trees is not appreciably better than for young trees; in the case of young trees which had been in tapping for only a short time the writer has often found a lower tensile strength, without, however, being able to attribute this with certainty to the youth of the trees;

- 2) the slope or type of the stress-strain curve is mostly the same; sometimes it is somewhat better for old trees;
- 3) the rate of cure diminishes in an appreciable degree for old trees; the oldest trees in plots of 15 and 40 years old gave the slowest curing rubber of all;
- 4) the viscosity for old trees is nearly always better; for very young trees it is often the average.

Attention is drawn to the fact that, in all these experiments, the rubber was made into sheets, as useable figures have not yet been obtained from rubber prepared as smoked sheet.

It is interesting to note that these results only partly confirm the opinion sometimes vented that rubber becomes better as the trees get older. The viscosity may be better from old trees, the slower and often much slower rate of cure might be considered as a less desirable property. In so far as young plantations do perhaps sometimes put on the market rubber of inferior quality, this may, at least partly, be due to the fact that older estates are as a rule better fitted and work more regularly, and thus produce a rubber which, in external as well as in its qualities, is more uniform and regular. To this may be added the fact that young trees give a relatively small quantity of latex with a low rubber content, which may lead to greater dilution when the cupwashing is added to the latex, etc. When the latex is not brought to a standard dilution, these factors may even go so far as entirely to change the so-called relative properties.

If the above mentioned fact, as to old trees giving a slow curing rubber, also holds good of the old trees in the primeval forests of Brazil, it may help to explain the rate of cure of Pará rubber. This rubber, which when coagulated with acetic acid, as on estates, should vulcanise owing to the age of the trees, develops without doubt a much greater rate of cure because the bolls remain wet for such a long time, whilst on the other hand the smoking retards vulcanisation somewhat, so that taken all together a rate of cure very much the same as of plantation rubber would be the result, as is in fact mentioned in current literature.

It may be added that on an estate in Java (Sidoarjo) near Semarang, where the latex coagulated in the ordinary manner with acetic acid gives a crepe which cures in 100 minutes, an adoption of the Brazilian method gives bolls with a rate of cure of 45-60 minutes. In the same way the latex from the old trees in Brazil, brought to standard dilution and coagulated with acetic acid, would probably give a slow curing rubber.

3- **Researches on the Coagulation of Rubber, in Java.** — DE VRIES, O. I. Sugar as a coagulant for crepe-rubber, in *Archief voor de Rubbercultuur in Nederlandsch Indië*, Year 1, No. 1, pp. 5-13. — II. Partial coagulation of latex, *Ibid.*, No. 3, pp. 17-184. Batavia, 1917.

I. — THE USE OF SUGAR AS A COAGULANT FOR CREPE-RUBBER. — The author gives the following summary of the results of experiments on coagulation of rubber by the aid of cane sugar.

Coagulation by the aid of cane sugar, as published by EATON (*Agric. Bull. F. M. S.* IV, 29), was taken up by the Besoekei and the West-Java Experimental Stations; the results of the former were only published at planters' meeting, the latter issued a special Bulletin on the subject. DRIER and SWART, *Mededeelingen Rubberproefstation West-Java*, No 6, abstracted in *Agric. Bull. F. M. S. V.*, 48). Several estates at the time when acetic acid was expensive made trials with this coagulant, and a large number of samples reached the Central Rubber Station for testing.

The result is that the difference between rubber coagulated by acetic acid and by sugar is insignificant. Tensile strength, slope (type after HUDROWITZ) and viscosity are nearly always the same, while in rate of cure a small difference is generally found, the sugar-coagulated rubber

curing slower or quicker as the case may be. This means that, with a running sale contract, the change from acetic acid to sugar would nearly always mean a change in the rubber delivered, which, unless warning were given, must be considered undesirable; but in general the small difference in rate of cure can form no objection to sugar as a coagulant, as the difference is well within the limits which are generally found for ordinary first latex crepe. In three series of experiments the uniformity from day to day (chiefly in respect to rate of cure) was not less with sugar-coagulation than with the ordinary acetic acid procedure.

Only one experiment as to the keeping qualities of sugar coagulated rubber has terminated so far, and it showed no harmful influence from the sugar. Several experiments have been started, however, and result will be published in due time. GORTER and SWART (l. c.) have proved that, in coagulation with sugar, the same acids are formed that act in the slow coagulation with small quantities of acetic acid, so that a prejudicial influence on the rubber is not to be expected.

As the difficulties in the practice of sugar coagulation (discolouration or scum formation on the surface; incomplete or very slow coagulation when using bisulphite, and therefore a darker and sometimes uneven crepe) can be overcome, as is shown by the above mentioned publications, sugar might possibly be the coagulant most fitted to replace acetic acid in case of need.

II. — PARTIAL COAGULATION OF LATEX. — Partial coagulation of latex may be obtained by adding smaller quantities of acetic acid than for ordinary coagulation, by which, according to the quantity of acid used, after a shorter or longer time, a larger or smaller part of the rubber separates in clots after addition of more acid, or eventually after standing over night.

The separation of a first clot in this manner is, however, only possible with undiluted latex of about 30 % rubber content; diluted latex, say 15 %, does not show this phenomenon, or only with difficulty.

This procedure has been tried on several estates in Java, and was for a long time followed on a big estate in West-Java.

It was — and rightly — supposed that by partial coagulation the impurities and part of the non-rubber substances of the latex (resins, etc.) would be separated, giving as a second clot the greater part of the rubber in a much purer state. In fact the first clot, when forming not more than 25 % of the total rubber, is (prepared as crepe) of a high yellow or dark brown colour, whilst the second clot, even without the use of bisulphite, is very pale. Further it is possible, in following this method of preparation to save acetic acid. It must be added, however, that the estate in question had to drop this procedure, as the brokers after some time declined to accept the "first clot" as first crepe rubber, and the pale second clot did not fetch a price which made this difference good.

Several series of samples, estate and experimental, have been tested and the difference between first clot and the rest may be summarised as follows:

	First clot	Rest
colour	saffron-yellow to brown	pale
viscosity	high	normal
tensile strength	high	normal
elastic strength	low	high
percentage of cure	somewhat higher	normal
coefficient of vulcanisation for standard curve	high	normal
	high	normal

This pronounced difference between a highly coloured and chemically pure, rapidly curing first clot with low tensile strength and high viscosity, and a pale second clot having nearly the ordinary properties of first latex, is only obtained when the first clot constitutes 15 to, at most, 25% of the total quantity of rubber, which is attained by using 1 part of acetic acid in 450 to 600 parts of rubber, or less; sometimes even by using bismuth only. By adding larger quantities of acetic acid at once, say 1: 250, the difference in quality with the second clot than tends to disappear.

It may be remarked that the substances (oxydases) causing the violet face-colouring of the coagulum also seem to be included for the greater part in the "first clot", as the first clot was often coloured by surface-oxidation, the rest remaining white.

As it might be supposed that the low tensile strength of the first clot might be ascribed to particles of dirt, etc., this point was investigated further, and it was shown by carefully rewashing and re-rolling both that this is not the case:

	Tensile strength of	
	first clot	rest
after rewashing	1.42	1.50
after re-rolling	1.40 1/2	1.49

Extensive determinations were also made of tensile strength, and the tensile strength of the first clot was found to be smaller for all states of cure; this investigation will be published *in extenso* in another place.

CAMPBELL, some time ago (Bull. Ceylon No 27), expressed the opinion that with partial coagulation no marked differences are obtained either in time of cure or in physical properties. As will be seen, the writer came to an entirely contrary conclusion and noted very pronounced differences in all respects. This controversy is easily explained, as CAMPBELL added 1 part of acetic acid in 88 parts of rubber at once, separating a first clot

with the MICHIE COLLEDGE machine in 5 minutes, the rest being completed a few minutes later. As we have shown, even with smaller quantities of acid (1 : 225 to 1 : 300), the first clot obtained shows only slight or practically no difference from the second clot, and it is only in acid in the proportion 1 : 450 or less that not more than 25 % of the rubber is separated as first clot and then shows the remarkable properties mentioned above.

959 - **Experiments to Prevent Rustiness in Sheet Rubber.** — ARENS, DR. P., in *Arbeid voor de Rubbercultuur in Nederlandsch-Indië*, 1st. year, No. 3, pp. 197-202. Batavia, 1916.

The author gives the following summary of his experiments on rustiness in sheets of the Hevea rubber.

The series of experiments were carried out on two different estates on both of which 90 % of the sheets showed rustiness.

Rustiness is caused by certain components of the serum (probably proteids) exuding from the rubber after the sheets are rolled and forming a thin invisible film on the surface of the rubber, when the water evaporates. When the sheet is stretched this film is broken up into small particles, which look like a yellowish-brown powder. The experiments demonstrated that rustiness results if the sheets are hung to drip for a long time after passing the diamond rolls, and that it may be prevented by putting them in the smoking-house as soon as they are marked. The addition of sodium bisulphite did not give any result.

Brushing the sheets with cold water before putting them in the smoking-house proved to be ineffective, though the amount of rusty sheet was somewhat reduced in this way.

Sometimes, sheets which are smoked directly after rolling become "greasy". This may be prevented by keeping the sheets under water for a night.

960 - **Investigation of the Methods and Costs of Marketing Butter in Kansas.** — MUELLER, THEODORE, in *Kansas State Agricultural College, Agricultural Experiment Station Bulletin*, No. 216, pp. 1-86. Topeka, Kansas, April 1917.

During a period of 18 months the Kansas State Agricultural Experiment Station made a thorough investigation of the methods, processes and cost of marketing butter made both on farms and in creameries of the State. Creameries reported the complete facts of their business for more than three-fourths of the Kansas creamery butter made during the period of study while representative farmers and stores gave accurate facts concerning their respective operations. The facts concerning the progress of Kansas dairying were obtained from numerous library sources and from pioneer Kansas dairymen. A summary of the investigation presented in this bulletin in 32 Tables and 42 diagrams and charts, brings forward the following facts and conclusions both of local and general interest :

1) Dairy farming in Kansas has been, and continues to be, a side line on the average farm. Experience with whole-milk creameries, local partial creameries, and skimming-station centralizers proved that they were not adapted to local conditions, and led to the establishment of cream-stations

direct-shipper centralizers which are well adapted to the conditions of Kansas dairy farming.

2) Farm butter-making has rapidly declined in Kansas owing to the increase in the efficiency of creameries. Nevertheless, there are many who make farm butter.

Those who sold the largest quantities obtained the best prices. Quality of farm butter depends upon specialization, which in turn is warranted when a large quantity can be made and sold. Only those who lived close enough to favourable markets found it worth while to make large amounts of farm butter.

3) The average farmer does not live close enough to favourable markets to make and market butter profitably, except in so far as the stores follow the practice of paying the same price for both good and poor butter.

4) Kansas has 78 creameries; 41 are centralizers which make more than ninety-five per cent. of the creamery butter of the state. Only one-third of the creameries make annually 10 000 pounds of butter or more each. Centralizers are necessary because there is only one creamery for each 1053 square miles, and the average farmer lives 19 miles from a creamery. This is too great a distance to drive, so that cream shipment is the farmer's economical choice.

5) The average creamery patron in the state sells less than one quart of a five-gallon can of cream per week. He finds it more profitable, therefore, to sell to the cream station at the cream station prices, than to ship direct and deduct from the delivered price, the expense of shipping a partly filled can. It is the small amount of butterfat supplied by the average creamery patron which accounts for the fact that 2020 cream stations deliver four-fifths of the butterfat from the farmer to the creamery. The farmers who produce sufficient cream to justify direct shipment are following this method.

6) The prices paid for delivered butterfat by centralizers averaged over Elgin prices, and according to prevailing economic conditions appear to be fair. The fact that butterfat prices in Kansas are somewhat lower than in some other states is because farmers choose to sell four-fifths of their butterfat through cream stations rather than to deliver the cream at their own expense. The difference between prices paid to farmers in Wisconsin and in Kansas, for example, was due to the difference in cost of shipping butterfat from the farm to the creamery in the two states. Kansas farmers, because they lived 19 instead of 5 miles from a creamery, on an average pay 3.46 cents to deliver their butterfat.

7) More and better dairy cows would have the effect of reducing the cost of getting butterfat to the creameries, of lowering the cost of making and marketing butter by the creameries, and would result in higher net prices and greater profits to the farmer.

1 - Figures showing the Conversion of Colostrum into Normal Milk, from the Standpoint of the Dairy Industry. -- See No. 227 of this Review.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

962 - "Gummosis" of the Sugar-Cane in Java. — GROENEWEGE, J., in *Archief voor de Suikerindustrie in Nederlandsch-Indië*, Pt. 16, pp. 597-638, pl. I-IX. Soerabaja, 1917.

"Gummosis" of the sugar cane is found all over Java, and but few varieties are immune. The disease is closely connected with the use in the plantations of cuttings with soft bark which rots easily. The products of putrefaction, besides preventing the growth of the plant, cause lesions in the roots and are the real cause of infection.

The danger of infection is greatest during the dry season and in light soils.

There is no danger of spreading the disease by cuttings from an infected plantation, as the presence of *Bacterium vascularum* alone is not sufficient to infect healthy plants.

The disease may be prevented by the use of cuttings with hard bark which are more resistant to rotting. Cuttings with one node only should never be used. The application of tar and Bordeaux mixture gave negative results.

963 - The Treatment of Sugar-Cane Cuttings with regard to "Sereh" Disease as Disease of the Phloem in Java. — VAN HARREVELD, PH., in *Archief voor de Suikerindustrie in Nederlandsch-Indië*, Pt. 15, pp. 557-589. Soerabaja, 1917.

The question of the supply of sugar-cane cuttings has recently attracted general attention. There is a demand for a cooperative mountain plantation which will produce cuttings of the types and varieties required by growers.

The author, who is the Director of the Sugar-Cane Experiment Station of Pasoeroean (Java), does not see in this measure a radical solution of the problem, and again discusses the question of cuttings in relation to the diseases mentioned. The results of his studies led to the following conclusions.

When a variety of sugar-cane is attacked by "sereh" in certain plantations in the plain, and the disease spreads, it is necessary that cuttings grown in the mountains be introduced.

The possibility of propagating these cuttings in special plantations in the plains depends on the extent of the disease. In order to judge the degree of susceptibility to the disease a special inspection of the plantation is imperative.

It is impossible to draw up any programme for the supply of cuttings; method efficacious for one plantation may be very costly for another. It is necessary to keep an exact record of all the results obtained from imported mountain cuttings, and especially of the productions obtained.

As soon as disease of the phloem appears, cuttings of a variety grown at a height of 2500 or 3000 feet during several generations should be obtained. Such cuttings may be propagated in special plantations at a lower altitude.

All these measures have already been carried out for many years at Java, and though a special, cooperative plantation is much to be commended, new results must not be expected from it. Moreover, it would be impossible to limit it to cuttings newly imported from the mountains; only the production of new varieties being capable of allowing a decrease in importation and expense.

A certain number of experiments with the new varieties in the plantations is the only means of ascertaining their qualities. Such experiments are already being carried out on a large scale in Java.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

The British Species of *Phomopsis*. — GROVE, W. B., in *Royal Botanic Gardens Kew, Bulletin of Miscellaneous Information*, No. 2, pp. 49-73, Pl. I-II, London, 1917.

GENERAL

The revision in 1916, of the large number of British specimens preserved in the Herbarium of Kew, under the genus *Phoma*, has revealed the existence in Great Britain, of a large number of species belonging, not to the genus *Phoma*, but to the genus *Phomopsis*. A list of these species arranged alphabetically is given here; the name of each being followed with its morphological or critical notes. The localities are only given when the species has not been previously recognised as British. Complete descriptions will appear in a work which is now in course of preparation.

Among the *Phomopsis* mentioned are:

- 1) *Ph. ambigua*, Trav., on twigs of *Pyrus communis*; possibly also on *P. malus*. The pycnidium of *Diaporthe ambigua*, Nits.;
- 2) *Ph. Amelanchieris*, Grove, on branches of *Amelanchier*;
- 3) *Ph. Celastrinae*, Grove, on twigs of *Euonymus americanus*;
- 4) *Ph. cinerascens*, Trav., on the branches of *Ficus Carica*. The pycnidium of *Diap. cinerascens* Sacc.;
- 5) *Ph. cistina*, Grove, on branches of *Cistus laurifolius*;
- 6) *Ph. Corni*, Trav., on twigs of *Cornus alba*, associated with *Diap. Corni*, Eckl.;
- 7) *Ph. cryptica* v. Höhn, on branches of *Lonicera* in Cheshire. The pycnidium of *Diap. cryptica* Nits.;

- 8) *Ph. exul*, Grove, on twigs of *Maclura aurantiaca* ;
- 9) *Ph. japonica* on twigs of *Kerria japonica*. The pycnidium of *Di. japonica* Sacc. ;
- 10) *Ph. juglandina* v. Höhn., on bark of trees of *Juglans regia*. The pycnidial stage of *Diap. juglandina*, Nits. ;
- 11) *Ph. Landeghemiae* v. Höhn., on twigs of *Philadelphus coronarius*. The pycnidium of *Diap. Landeghemiae*, Nits. ;
- 12) *Ph. Lebiseyi*, Died., on branches of *Negundo aceroides*. Pycnidium of *Diap. Lebiseyi*, Niessl. ;
- 13) *Ph. Lysimachiae*, Grove, on stems of *Lysimachia vulgaris* ;
- 14) *Ph. Malvacearum*, Grove, on stems of *Malva moschata* ;
- 15) *Ph. Mulleri*, Grove, on branches of *Rubus fruticosus*, and *R. Idaeus* ;
- 16) *Ph. nitidula*, Grove, on stems of *Scrophularia nodosa* ;
- 17) *Ph. occulta*, Trav., on scales of cones of *Picea excelsa*, at Malvern and Dolgelly. The pycnidium of *Diap. occulta*, Nits. ;
- 18) *Ph. Platanoides*, Died., on twigs of *Acer pseudoplatanus* ;
- 19) *Ph. Prunorum*, Grove, on twigs of *Prunus Laurocerasus* and *lusitanica*. Possibly the pycnidium of *Diap. viridarii* Sacc. ;
- 20) *Ph. pterophila*, Died., on samarae of *Fraxinus excelsior*, but not on the thick part enclosing the seed, not on the wing. Pycnidium of *Di. samaricola*, Phill. and Plow ;
- 21) *Ph. quercella*, Died., on twigs of *Quercus* ;
- 22) *Ph. quercina* v. Höhn., on branches of *Quercus* at Malvern ; considered to be the pycnidium of *Diap. leiphaemia* Sacc. (*Valsa leiphaemia* F)
- 23) *Ph. Robergeana*, Died., on twigs of *Staphylea pinnata* ; probably the pycnidium of *Diap. Robergeana*, Niessl. ;
- 24) *Ph. Rosae*, Grove, on prickles of *Rosa canina* ;
- 25) *Ph. rudis* v. Höhn., on twigs of *Laburnum* ; pycnidium of *Di. rudis* Nits. ;
- 26) *Ph. Ryckholtii* v. Höhn., on branches of *Symphoricarpos racemosus*. The pycnidium of *Diap. Ryckholtii* Nits. ;
- 27) *Ph. salicina*, Died., on branches of *Salix babylonica*, *S. v. nalis*, and other species ;
- 28) *Ph. sambucina*, Trav., on twigs of *Sambucus nigra*. The pycnidium of *Diap. circumscripta* Otth. ;
- 29) *Ph. scobina* v. Höhn., on twigs of *Fraxinus excelsior*, frequently accompanied by *Diap. scobina* Nits., of which it is the pycnidium ;
- 30) *Ph. striaeformis*, Grove, on twigs of *Kerria japonica* ;
- 31) *Ph. velata*, v. Höhn., on bark of *Tilia* spp. The pycnidium of *Di. velata*, Nits. ;
- 32) *Ph. viridarii*, Grove, on twigs of *Magnolia grandiflora*.

There follow some species excluded for the present from the British

965 - **New Japanese Fungi**. — TANAKA, TOSAKURO, in *Mycologia*, Vol. IX, No. 3: 1917 and No. 4, pp. 249-253, Lancaster, Pa., 1917.

The writer proposes to supply American and European phytopathologists, by means of a series of papers prepared for the purpose, with pro-

full information regarding newly discovered Japanese fungi that have not been described only in Japanese.

The descriptions given in the two papers analysed (which are the first in the series), are taken from different Japanese publications which appeared in 1915 and 1916.

As regards the Japanese fungi discovered before those dates, there are two: one is by PROF. J. MATSUMURA (*Index plantarum japonicarum*, I. *Cryptogamae* [Fungi, pp. 127-184], 89, Tokyo, 1904) and gives in alphabetical order the species with synonymy, host plants and localities, all in Latin; the other by PROF. M. SHIRAI (*A List of Japanese Fungi hitherto Known*, pp. 89, Tokyo, 1905), giving an alphabetical list of species with synonymy in Latin and the host plants in Japanese characters only. Localities are not given.

The more important fungi causing plant disease in Japan are treated by PROF. A. IDETA (*Handbook of the Plant Diseases of Japan*, 4th. ed., 1904-49, Tokyo, 1909-1911). A 17-page index gives the Latin names of the fungi described. Prof. IDETA is now writing a supplement bringing this book up to date.

After this preface, we now give a list of the species of which the writer reproduces the descriptions.

1) *Valsa (Euvalsa) Paulowniae*, Miyabe and Hemmi sp. nov. (in *Journal of Plant Protection*, published September 1916). This fungus attacks *Paulownia* tree first on the twigs, and spreads over the branches, finally covering the entire trees down to the roots. The infection occurs in winter and early spring, mostly on the wounded, or dead, parts of shoots, which gradually become rough, dry and brown and finally crack, while irregular elevated spots appear on the surface, these being the stromata of fungus. This "Tachigare", or dieback disease, first appeared in *kaidô* about 1910 and seriously damaged *Paulownia* first in 1913 and then, when many old trees were killed. In 1915, the disease spread all over Hokkaidô, and in one case, about 3000 trees at the same place were killed. For its prevention, the trunks of the trees should be wrapped in paper in winter, so as to prevent freezing or wounding. The trees should be sprayed with Bordeaux mixture in early spring.

2) *Ophiochaeta graminis* Sacc., H. Hara n. comb. (May 1916). This fungus, commonly called *Ophiobolus graminis* Sacc., is known as the cause of root-rot of wheat and barley in France, Belgium, Germany and Japan (1). It was first discovered in a similar disease on rice, and proposed to transfer to the genus *Ophiochaeta* on account of the existence of bristle hairs

(1) This parasite has also been recorded in different regions of Italy as causing severe damage not only to wheat and barley, but also to rye and oats. It has also been found on *Agrostis* sp., and is known in England under the name of straw blight. The fungus does much injury to wheat in Australia, where it has also appeared on *Bromus sterilis*. Cfr. FERRARIS T., *Parassiti vegetali delle piante coltivate od utili* 2nd. ed., pp. 436-439. Milan, Hoepli, 1915; SER G., "Diseases of Cultivated Plants and Trees", pp. 226-227. London, Duckworth & Co., 1910. (Ed.)

on the perithecium. He suggests the following factors in preventing disease: selection of a resistant variety; necessity of avoiding the use of too much nitrogenous fertiliser; not allowing too much water on the soil; the application of farmyard manure.

3) *Marssonia Carthami* T. Fukui, sp. nov. (June 1916); on living leaves of young plants of the Composite *Carthamus tinctorius* L. (Called "Ben bana" in Japanese and "Hung-hud" in Chinese), at Abegun, Shidzuoka-ken, Japan.

4) *Mycosphaerella Hordicola* Hara sp. nov. (July 1916). On the blades and culms of wheat, barley and naked barley (*Hordeum trifurcatum* Jac.) Its distribution is as follows: Ukishima-mura (1913); Inasagun, Jinomura; Aratama-mura (1914); Fuji-gun, Obuchi-mura (1915); Agehara-mura, Shidzuoka-ken, Suntô-gun, Kanoaka-mura (1916). Local names of the disease: "Mugi no Tachigare", "Kuse"; new Japanese name "Mugi no Kigarebyô". A barley variety "Dobu" seems resistant to the disease; on the other hand "Oku-mikawa" is very susceptible. The disease is much injurious when seeds are sown earlier than the usual planting time. It becomes virulent when nitrogenous fertilisers are used too freely. The phates are effective in strengthening the growth of the culm to withstand the disease. Lime, flowers of sulphur and Bordeaux mixture all lessen the damage done by the parasite.

5) *Scorias capitata* K. Sawada sp. nov. (February 1915), on the upper surface of the leaves of *Thea sinensis* L., sometimes covering also the lower surface and, even the twigs, at Taihokuchô Chonaihô-shô (Formosa), December 1907.

6) *Zukalia Theae* K. Sawada sp. nov. (February 1915) on leaves and twigs of *Thea sinensis* at Shinchiku-chô, Sanshaka, Formosa, in May 1907.

7) *Zukalia nantoensis* K. Sawada sp. nov. (March 1915) on leaves of *Thea sinensis*, at Nantô-chô, Gyochi, Taiwan (Formosa) in October 1907 and at Nantô-chô Shinjô, Taiwan (Formosa), in October 1915; this fungus causes the disease of the tea plant called Susu-byô (Sooty mould disease) in Formosa and mostly occurs with *Z. theae* K., *Scorias capitata* and *Capnodium Footii* Berk. and Desm.

8) *Pestalozzia Theae* K. Sawada sp. nov. (February 1915) on leaves of *Thea sinensis*; the diseased spots are brown when young, but when mature become grey with a brown margin. They are usually 1 cm. in diameter sometimes covering half a leaf. Type localities: Taihokuchô Zuihô (1907), Taihokuchô Kusshaku; Taihokuchô Mokusaku; Taihokuchô Shintai; Taikokuchô, Rigyokutsu (1908); Taihokuchô, Hokuseiko (1907); Taikokuchô Chonaihô (1908, 1909, 1910); Tôenchô Kessishô; Tôenchô Dôrak; Tôenchô Anheichin (1908); Shinchikuchô Shinpo; Akôchô Kôkô (1909).

9) *Sclerotinia Fagopyri*, S. Hori sp. nov. (March 1916). The rot form inside the seeds of *Fagopyrum esculentum* Moench, and probably germinate twice a year.

10) *Phytophthora Allii*, K. Sawada sp. nov. (March 1915), on the leaves and flower stalks of *Allium fistulosum* at Taihoku-chô Chonaihô-shô, Formosa (Formosa) in February and July 1913. An attempt to inoculate

- nary onion with this fungus was not successful; the only plant susceptible to the disease inoculation test was *Epiphyllum truncatum* Haw. The disease is not at present widely distributed and the injury not very serious.
- 11) *Phyt. Melongenae* K. Sawada sp. nov. (March 1915), on the fruits of the egg-plant (*Solanum Melongena*). All the Japanese varieties of *S. melongena* are susceptible to this disease, and in one case 60 to 70 per cent. of the crop was lost. Inoculation tests proved that the disease can be produced on tobacco, tomato, potato, figs, *Areca Catechu*, *Hibiscus esculentus* and, to a lesser degree, on *Epiphyllum truncatum* and *Ricinus communis* L.
- 12) *Massaria phorcioides*, I. Miyake sp. nov. (December 1916), common on twigs of *Morus alba* on which it is probably parasitic. This fungus is found throughout China and Japan. Type localities: Gifu-ken (prefecture) Zu-gun Kaisai-mura; Fukuiken (prefecture), Tsuruga and Yamagata (prefecture), Yamagata-shi (1915); Akita-Ken (prefecture) Akita-shi, Iitate-chô, Iwateken (prefecture) Fukuoka-chô and Kyôto-fu (prefecture) Ayabe-chô (1915).
- 13) *M. mori*, I. Miyake sp. nov. (December 1916), on twigs of *Morus alba* at Akita-Ken (prefecture) Yuzawa-chô (March 1915), and at Kyôto-fu (prefecture) Ayabe-chô (April 1915).

Vegetable Parasites Observed on Cultivated Plants in the Dutch East Indies. — See No. 978 of this Review.

The Acidifying Action of the Basidiomycete *Coniophora Cerebella* on Timber. — PETRI, L., in *Annali del R. Istituto superiore di Scienze Nazionali*, Vol. II (1916-17), pp. 433-447, figs. 1-2. Florence, 1917.

The investigations of MÖLLER, FALCK and SCHAFFNITZ have shown that the fungi capable of determining a primary infection of timber, *Coniophora cerebella* A. and Sch. is without doubt the most widespread. These primary infections, which cause dry rot, later lead to secondary infections by other fungi, among which is *Merulius lacrymans*, thus causing the complete destruction of the wood.

The results of experiments on this subject lead FALCK to the conclusion that the predisposition of wood to attacks by *Merulius* in the case of spore infection, is determined by the acidification of the medium by *Coniophora* and other fungi.

WEHMER opposes this opinion, and considers that, very often, the growth of *Merulius* on unsterilised wood or the germination of *Merulius* spores, are retarded by saprophytic bacteria or fungi which multiply by fission, and develop in spite of the low acid reaction of the wood; this action is more marked if the wood is neutralised by alkalis or alkaline salts. The retarding influence of acids on the germination of *Merulius* spores probably lies precisely in the fact that it inhibits the concurrence of other non-microorganisms.

His discussion is of practical interest where the treatment of wood is concerned, since it seeks to determine whether infection by *Merulius* can be caused by spores or only by contact with wood which is already diseased. As WEHMER thinks, the natural acidity of wood is not sufficient to

protect the mycelium derived from the spores against the antagonistic action of schizomycetes or fungi which multiply by fission, all danger of the spread of infection by spores is removed, or, at least, must be very rare. If, on the other hand, as FALCK thinks, dry rot, or any other action of microorganisms, by increasing the natural acidity of the wood, assures the germination of the spores and the growth of the resulting mycelium, infection by spores constitutes a great danger.

A first series of experiments undertaken by the author for the purpose of clearing up this question showed that *Con. cerebella* can have an acidifying action of wood. This acidification, which is very slight, is due to oxalic acid (potassium acid oxalate); it is subordinated to the rate of growth of the mycelium and to its metabolism.

The superficial growth of the mycelium alone, without subsequent destruction or alteration of the constituents of the cell walls, does not determine an increase in acidity, but gradual and continuous oxidation, especially of the tannic acid, by the action of the oxidases, causes a decrease of the original acidity. This same fact may be verified in the case of wood which has been strongly attacked and altered, if cultivation is prolonged beyond a limit, which varies in different woods, and depends on the quality and quantity of the food at the disposal of the mycelium.

It may happen that the same wood attacked by *Coniophora*, but analysed at various periods, shows an increase or a decrease in the original acidity. These variations must be taken into consideration when studying the conditions rendering wood susceptible to attack by *M. lacrymans*.

The *Coniophora* mycelium, developing on wood, has no antagonistic action against many species of ordinary bacteria and moulds (*Penicillium*). The investigations are to be continued.

968* - **Patents Relating to the Control of Plant Diseases and Pests.** — See Note on this Review.

969 - **A New Disease of Wheat, Probably of Bacterial Origin.** — SMITH, EDWIN. In the *Journal of Agricultural Research*, Vol. IV, No. 1, pp. 51-53, pl. 1-8. Washington, D.C. 1917.

Preliminary notice is given of a disease of *Triticum* spp. which has appeared in various parts of the United States of America. It was first observed in 1902 on wheat from Indiana, being considered as probably of bacterial origin. It was again found, in 1915, in large quantities of material from Kansas and Indiana. In 1917 the disease was observed in Texas, Oklahoma, Kansas, Arkansas, Missouri and neighbouring states.

The disease is being fully studied in the Washington Plant Pathology Laboratory in collaboration with the Kansas and Wisconsin Experiment Stations.

The disease is characterised by the appearance of black, longitudinal parallel stripes of varying depth, on the glumes of the wheat when it is nearing maturity. The stripes are usually more numerous and marked on the upper parts, where they often fuse; they frequently reach to the base of the glume. Inside, in the parts corresponding to the stripes, the glume

ve black or brown spots, invaded by bacteria; in some cases fungi are so found. In bearded wheats the awns are often attacked and discoloured, least at their base. In the advanced stages of the disease the rachis and lam are covered with black or brown streaks. The leaves too are attacked. When the disease is serious the caryopses appear very shriveled, and, sometimes, there are cavities filled with bacteria in them. As the ears are unted and the caryopses considerably shriveled, there is a corresponding duction in yield.

For next autumn, only seed from fields known to be free from this euse should be used, and no manure should be used derived from animals ose food or litter contains straw attacked by it. Such manure should ly be used on fields in which neither wheat nor other cereals are grown. nimals fed on the straw of the diseased wheat should be kept away from lds in which wheat is to be grown.

5 - *Ustilago nuda* and *U. Triticci*, Observed Respectively on Barley and Wheat in Java. — VAN HALL, C. J. J., in *Teymannia*, Year XXVIII, No. 1, pp. 24-27. Batavia, 1917.

For some time past interest in the cultivation of wheat has been rewed in Java. With the help of the Department of Agriculture experi-ental plots have been set out and it is proposed to introduce large quanti-s of seed wheat into the Island.

Although cultivation has started so recently, diseases of cereals have ealy appeared in the Dutch Indies; chief amongst them are smut of rley (*Ustilago nuda*) and smut of wheat (*U. Triticci*).

The way smut was brought into the island shows how easy it is to in-duce a disease by means of seeds. In 1915, horses for the army arrived in China. While on board they were fed on barley, and a small quantity this cereal came with the horses to the army deposit. Without any spe-ic end in view a little of this barley was sown at Padalarang, where the re-deposit is; shortly after the plants were attacked by *U. nuda*. It ould be noted that barley is cultivated in no other part of Java.

In 1916, the Department of Agriculture obtained seed wheat from dia and Europe. The plants from these seeds were attacked by various eases, amongst them smut.

Special attention is drawn to these facts, and the urgency of disinfect-: the seed by treatment with hot water (JENSEN's method) is insisted on.

1 - *Septoria Persicariae* n. sp., a new Leaf-Spot Disease of *Polygonum Persicaria* in Utah, United States. — O' GARA, F. J., in *Mycologia*, Vol. IX, No. 4, p. 218, plate 10, Lancaster, Pa. 1917.

The writer describes, as a species new to science, *Septoria Persicariae* ich is parasitic on the living leaves of *Polygonum persicaria* L., producing inspicious spots upon the upper and lower surfaces. These spots, which e nearly circular, are from 1 to 8 mm. in diameter; they occur either eolate, or united, and are at first rusty brown in colour. Later, they come brownish grey or grey towards the centre, being surrounded with arrow purplish-red or violet border.

The fungus, which is represented by a small number of specimens, was found in July 1914 and August 1916 by Mr. W. W. Jones in Salt Lake Valley.

972 - *Bacterium citrarefaciens*, sp. nov., the Cause of the Disease of Orange and Lemon Trees known as "Citrus Blast" in California. — LEE, H. A. THORSON, *Journal of Agricultural Research*, Vol. IX, No. 1, pp. 1-8, plates A, 1-2, Washington D. C., 1917.

Since 1912, a disease of orange and lemon trees has repeatedly been recorded in north and central California. In 1916, Dr. J. E. Corr, finding no similar disease described in scientific literature, gave it the name of "Citrus blast".

The disease is first noticed during the rainy season of California, usually about the middle of January. Young leaves are found to be dropping, sometimes leaving whole branches bare. On examining more closely, black, discoloured areas are noted on the leaves; such areas are found most commonly at the junction of the leaf blade and the wings of the petiole. The affected parts have a water-soaked appearance, and the whole leaf loses its rigidity and hangs limply from the branch. Less commonly, such water-soaked lesions appear near the tips of the leaves.

The blackened areas frequently spread down the petioles of the leaves into the twigs upon which the leaves are borne. If such a twig is young and actively growing, the diseased area spreads quickly, and the whole twig becomes black and shrivelled. The disease has never been found spreading down into the mature wood.

In California, there occur in March, periods of several days in which the weather becomes very warm, and the orchards dry up to some extent. Such weather causes the affected tissues at the base of the leaf blade and the affected leaf petioles to dry up, become rigid, and the leaves to droop.

In many cases, the lesion spreads from the petiole of a leaf down into the twig tissue which is still soft, but not actively growing, and a small black area is formed round the base of the petiole. After the leaf has dropped off and the dry season begins, brown blister-like scabs are formed on such affected areas. As the twig continues growing, these scabs become loose and may be cast off the following autumn. On trees which have been affected in the spring, however, such blisters are frequently found in the succeeding winter, and these are presumably the sources for the dissemination of the disease.

On January 24, 1916, fresh material of "Citrus blast" was sent from Palermo, Cal. Sections through the lesions were made and the tissues were seen to be filled with motile bacterial organisms. On isolation plates, bacterial colonies were obtained which, on inoculation into orange trees in the greenhouse, produced the typical lesions of the disease. From such positive inoculations the organism has been re-isolated and re-inoculated, again giving positive results, after which it was again isolated.

This bacterium is a distinct species new to science, and is described in detail under the name of *Bacterium citrarefaciens*. It lives in the protoplasm, destroying the cell structure and leaving large pockets filled with

acterial masses. The microorganism does not ordinarily invade the vascular bundles and is apparently restricted to the parenchyma.

The disease causes a decrease in leaf surface and a loss of the fruit-bearing wood in orchard trees.

Young trees in nurseries may also be injured.

3 - Studies on the "Ink Disease" of the Chestnut Tree in Italy (1). — *Petri, L.*, in *Annali del R. Istituto superiore forestale nazionale*, Vol. II (1916-1917), pp. 219-309, figs. 1-14, pl. II-V. Florence, 1917.

This report gives the results of numerous investigations carried out since 1907 in the provinces of Novara, Lucca, Pisa, Florence and Rome.

The specific infection causing "ink disease" in the chestnut tree is localized in the cambium at the base of the main roots and neck till just above the surface of the ground.

The parasite consists of a multicellular mycelium, which, however, may remain unicellular during a more or less long period of time; reproduction intercellular and intracellular, but, at present the organs of reproduction are unknown both in the cambium and in the most varied artificial media. In the cambium it forms globular and thread-like haustoria.

Infection is usually caused by direct contact of healthy roots with infected material. The mycelium may enter through superficial wounds, fissures of the bark, or small places where the peridermis has already been partly softened by the action of other weak parasitic microorganisms. Once the cambium is attacked, the mycelium spreads more or less rapidly in all directions along the largest roots, the neck, and the lowest part of the stem. The path of the plant follows on the complete infection of the cambium of the trunk.

In most cases the disease caused by the specific infection is complicated with one caused by dry rot of the heartwood, which spreads in a centrifugal direction and is produced by various polypori. After the cambium has been invaded the sapwood is usually invaded by a large number of saprophytic fungi which generally come from the diseased heartwood. The progress of the parasitic mycelium along the cambium is closely followed by these saprophytes, which also invade the bark. These facts, together with the rapidity with which the specific agent of the disease disappears after the death of the tissues in which it developed, explain the difficulty of determining the true cause.

The same phenomena occur at the base of the main roots. The secondary infection which spreads from the neck to the free parts of the roots must be clearly distinguished from the primary infection which results in a direct attack of the specific parasite. In the first case, the disease spreads from the interior to the exterior, till the "ink stains" appear on the bark ("secondary stains"). In the second case, the black rot passes from the exterior to the interior on roots whose sapwood and heartwood are perfectly healthy ("primary stains").

(1) See also *R.*, April 1917, No. 387.

An impermeable subsoil, abundant clay, a damp and warm position sheltered from north winds, all render chestnut trees susceptible to the disease. Attacks on the trunk by *Polyporus sulphureus* do not in any way render the tree more susceptible to the disease, on the contrary, trees invaded by this polyporus are much less liable to "ink disease". This must be explained by the different physiological requirements of the specific parasites of the disease and of *P. sulphureus*. Whereas the former requires tissues rich in water, the latter prefers the heartwood, very poor in water, of chestnut trees which, owing to their position, often suffer from drought.

Weak parasites may attack the branches when infection of the cambium of the neck, or some of the main roots has already set in. These mycoses of the leaves often aggravate the symptoms of decay due to the disease, but are not of necessity a complement to it.

Coryneum perniciosum Br. and Farn. is the most virulent of these parasites, and finds particularly favourable conditions in chestnut trees which are already suffering from "ink disease" or ordinary root rot. For chestnut trees, whose trunks have a soft peridermis may be attacked either on a level with the soil or just above it, and may be killed in a few days by *C. perniciosum* when the specific cause of "ink disease" is already present in the neck.

Attack by *Coryneum* therefore never forms an independent specific disease, but is a complementary disease subordinate to an alteration of infectious origin in the roots and the neck.

The European forms of *Endothia radicalis* or similar parasites, have almost the same effect as *C. perniciosum*, although their action resembles that of wound parasites.

The most certain characteristic for the diagnosis of sick plants lies not only in the black rot of the roots, but in the longitudinal patches of decay in the cambium of the stem, ending at the top, in a point a little above the level of the soil.

No definite results have yet been obtained from the experiments on the improvement of chestnut plantations with resistant stock plants. In the meantime it is advisable to destroy and isolate all infected areas as soon as the existence of the disease is established.

A bibliography of 95 works is appended.

974 - New Species of *Peridermium* on *Pinus* in the United States. — HEDGECOCK, G. and HUNT, N. REE, in *Mycologia*, Vol. IX, No. 1, pp. 230-242. Lancaster, Pa., 1917.

A systematic description of the following uredineae:

1) *Peridermium ipomoeae*, sp. nov., the aecidial form of *Coleosporium ipomoeae* (Schw.) Burrill, collected on the needles of *Pinus echinata* Mill. (Alabama, Arkansas, Georgia, North Carolina, South Carolina, Texas and Virginia), *P. palustris* Mill. (in Florida and South Carolina), *P. rigida* Mill. (in Georgia, Maryland, Pennsylvania and South Carolina) and *P. taeda* L. (in Alabama, Arkansas, Florida, Georgia and South Carolina).

2) *Per. terebinthinaceae*, sp. nov., the aecidial form of *Coleosporium terebinthinaceae* (Schw.) Arthur, collected on *P. echinata* (in Alabama).

Georgia, North and South Carolina) and *P. Taeda* (in Alabama); a form which may be this species has been collected on *P. pungens* Michx. f. Georgia) and on *P. virginiana* Mill. (North Carolina);

3) *Per. Helianthi*, sp. nov., the aecidial form of *Coleosporium elianthi* (Schw.) Arthur, collected only on *P. virginiana* (Pennsylvania, North and South Carolina, Tennessee, West Virginia and Virginia), but it probably will be found later on *Pinus echinata*;

4) *Per. fragile*, sp. nov., on *P. palustris* (Florida and Georgia), *P. acida* (Florida), and *P. rigida* (New Jersey);

5) *Per. minutum*, sp. nov., on *P. glabra* Walt. and *P. Taeda* (Florida).

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

5 - Observations on British Coccidae (1). -- GREEN, F. ERNEST, in *The Entomologist's Monthly Magazine*, Vol. LIII (Third Series, Vol. III) No. 33 (No. 640), pp. 201-210, figs. 1-9. London, September 1917.

GENERAL

The writer treats in his paper of the following Coccidae:

1) *Lecanium bituberculatum* Targ., a species occurring abundantly on a small section of hawthorn hedge in Camberley (March 26, 1917);

2) *L. capreae* L. Dr.; IMMS sent the writer an example of this coccid on *Myrica gale* at Pwllheli, Carnarvon. The writer also received the same insect on *Cerasus Laurocerasus* (= *Prunus Laurocerasus*) from which where it was found by Mr. H. D. TAYLOR. Both plants constitute records for the species;

3) *L. nigrum*, var. *depressum* Targ., especially abundant on the under-surface of the fronds of a species of *Musa* and occurred more sparsely on *Chrysophyllum Malacantha* and *Ficus* spp., in the palm house of Royal Botanic Gardens, Kew (in December 1916);

4) *L. persicae crudum* n. subsp. on leaves of *Aralia*;

5) *L. hesperidum* L. var.; Dr. IMMS has submitted specimens of this coccid which had been found on an orange plant raised from seed in the Botanical laboratory at Manchester University;

6) *L. signiferum* Green, on *Polypodium aurum* in a plant house at Royal Botanic Gardens, Kew (December 1916);

7) *L. zebrinum* n. sp., on branches and young stems of *Betula alba*, very commonly on sapling plants; also on sapling *Populus tremula* at Camberley (May-June 1917). An adult male emerged on June 2; young larvae hatched from beneath the scales on June 22. The females are extensively parasitised by two different species of Chalcids. The new species of coccid very closely related to *L. ciliatum* Douglas, which occurs on oaks;

8) *L. transvittatum* n. sp., on *Betula alba* at Camberley (June 1917). This species seems to be extremely scarce, many hours of diligent search having resulted in the discovery of only 4 individuals. Of these, 3 were found on

(1) See also *B.* August 1915, No. 867; *R.*, June 1916.

(Ed.)

the lateral branches of sapling trees of *B. alba* and the fourth on a small branch of an older tree. Young larvae commenced to appear on June 22.

9) *Lecanopsis longicornis*, Green. This species was described from 3 examples taken in 1915. The insect was afterwards found in comparative abundance on *Carex ovalis* in damp meadows, near Camberley (July 1916). Young larvae were emerging on July 18;

10) *L. bulleri* n. sp. This new species was first brought to the notice of the writer by Mr. E. A. BUTLER who swept it from grass at Royston Heath, Herts (May 28, 1917). The specimens found by Mr. BUTLER, though apparently adult, were not quite fully grown. Subsequently (on June 22) Prof. NEWSTEAD and the writer discovered at Camberley fully mature specimens with ovisacs full of eggs. The parent insects were mostly dead, having been attacked by chalcid parasites which afterwards emerged in considerable numbers. The young coccid larvae began to emerge in considerable numbers on July 15;

11) *Parafairmairia gracilis* Green, observed on July 14, 1917 upon undetermined host plants; in the writer's opinion the insect particularly affects various species of *Carex*;

12) *Eriopeltis festucae* Fonscol., on the upper surface of the leaves of *Festuca*;

13) *Luzulaspis luzulae* Dufour; this occurred not only on *Luzula* but also on *Carex ovalis* at Camberley;

14) *Ceroplastes rusci* L., examples of this species were sent to the writer on green figs imported from Italy. Though it cannot be regarded as a British coccid, *Ceroplastes rusci* belongs to the same category as *Parlatoria zypfi* and *Lepidosaphes citricola* which are included in the British list the strength of their occurrence upon imported fruits in the markets of Britain.

976. Coccidae Observed in the Royal Botanic Gardens, Kew, England. — G. E. ERNEST, in *Royal Botanic Gardens Kew, Bulletin of Miscellaneous Information*, N. pp. 73-76, London, 1917.

In May 1896, when visiting the plant houses at the Royal Botanic Gardens at Kew, the writer observed 16 distinct species of Coccidae. Prof. NEWSTEAD, as the result of a visit the same year, brought up the number to 22. On December 7, 1916 on once more visiting the Gardens, the writer again found 16 species (represented for the most part by few individuals), 3 of which had not previously been recorded from the Gardens (indeed from the British Isles) and one of the 3 was new to science. The list published by the writer contains:

1) *Lecanium tessellatum* Sign., common on various palms, also on *Tabernaemontana* sp., *Ardisia humilis* and *Ochna pumila*.

2) *L. hemisphaericum* Targ. on *Carissa* sp. and *Rheedia* sp.

3) *L. longulum*, Dougl., on *Monodora* sp., *Treculia* sp. *Carissa* and *Excoecaria discolor*.

4) *L. oleae* Bern., on *Erythrina* sp.

5) *L. nigrum* (?) var. *depressum* Targ., abundant on *Musa*, rarely observed on *Chrysophyllum* sp., *Malacantha* sp. and *Ficus* sp.

6) *L. signiferum* Green, on *Polypodium aureum*. This insect has hitherto been recorded from Ceylon and India only.

7) *Pulvinaria floccifera*, Westw., on *Cordia* sp. A common hot-house pest attacking orchids chiefly.

8) *Pseudococcus longispinus*, Targ. This appears to be the most widely distributed coccid in the Kew houses. Among its numerous plant hosts are *Musa*, *Cycas*, *Euphorbia* and *Cotyledon Pringlei*.

9) *Ps. citri* Risso : this usually common greenhouse pest was noticed only on *Solandra* and a species of *Euphorbia*.

10) *Ps. nipae* Mask., rather common on various palms ; more particularly on *Cocos*, *Kentiospis* and *Sabal*. This species had not previously been recorded from the British Isles. Mr. FRYER sent the writer examples of this insect taken on an imported palm, but the insect must have been established at Kew for some considerable time, though hitherto unnoticed.

11) *Diaspis echinocacti* Bouché, on *Cereus* sp.

12) *Hemichionaspis aspidistrae* Sign. on *Polypodium aureum*.

13) *Aspidiotus ficus* Ash., on *Pandanus* sp.

14) *A. hederæ* Vallot, on *Euphorbia* sp. and *Asparagus falcatus*.

15) *Ischnaspis filiformis* Dougl., abundant on various palms.

16) *Lepidosaphes* sp. nov., on *Nephrodium* sp.

After collecting all the data which exist on the subject, it may be said that the species of *Coccidae* hitherto known to be present in the hot houses of the Kew Botanical Gardens are as follows:

1) *Icerya aegyptiaca*; 2) *Orthezia insignis*; 3) *Asterolecanium bambusae*. *Coccus tomentosus*; 5) *Gymnococcus agavium*; 6) *Ripersia filicicola*; 7) *Pseudococcus citri*; 8) *Ps. longispinus*; 9) *Ps. nipae*; 10) *Vinsonia stellata*; 11) *Pulvinaria floccifera*; 12) *Lecanium hemisphaericum*; 13) *L. nigrum*; 14) *L. nigrum-depressum*; 15) *L. oleae*; 16) *L. hesperidum*; 17) *L. signiferum*; 18) *L. longulum*; 19) *L. tessellatum* (*L. perforatum*); 20) *Pinnaspis buxi* (= *P. pandani*); 21) *Hemichionaspis aspidistrae*; 22) *Diaspis salicivallii*; 23) *D. echinocacti* (= *D. calyptroides*); 24) *D. carueli*; 25) *D. stagona*; 26) *D. persimilis*; 27) *Howardia biclavis*; 28) *Aspidiotus ficus*; 29) *A. hederæ*; 30) *A. personatus*; 31) *A. spinosus*; 32) *A. dictyospermi*; 33) *A. cyanophylli*; 34) *A. perseae*; 35) *A. aloes* (probably wrongly determined); 36) *Gymnaspis acchmeae*; 37) *Parlatoria pergandi-crotonis*; 38) *Florina kewensis*; 39) *Poliaspis cycadis*; 40) *Lepidosaphes pinnaeflorae*; 41) *Lepidosaphes* sp. nov.; 42) *Ischnaspis filiformis*.

Observations on the *Coccidae* of Europe, Africa and America. — NEWSTRAD, ROBERT, in *Bulletin of Entomological Research*, Vol. VII, Part 1, pp. 343-380, figs. 1-27, plates VI-VII. London 1917.

Systematic description of:

1) *Platysaissetia carpenteri* sp. nov., on the trunk of a fig tree at Nambura Is. (Uganda);

2) *Pl. ferox* sp. nov., on a shrub with hard wood in the Botanical Garden at Calabar (South Nigeria);

3) *Akermes andersoni* sp. nov., on orange leaves at Kabete (British East Africa); the tree was seriously attacked;

- 4) *A. quinquepori* sp. nov., on *Microlobium acaciaefolium* in the Botanical Garden of Georgetown (British Guiana); the insect has as a natural enemy a small black ant;
- 5) *Lecanium hirsutum* sp. nov., on an indeterminate host plant in East Africa;
- 6) *L. pseudotessellatum* sp. nov., on *Chrysobalanus pellocarpus*, Aripo, Savana, Trinidad;
- 7) *L. wardi*, sp. nov., on the leaves of the Malacca apple (*Eugenia malaccensis* in the Botanical Garden at Georgetown; numerous individuals of this species were attacked by a fungus);
- 8) *L. aequale* sp. nov., on "coupida" (*Avicennia nitida*) on the shore, east coast, British Guiana;
- 9) *L. acaciae* sp. nov. on *Acacia melanoxylon* and *Albizzia molucca* at Nairobi (British East Africa); the insect is attacked by the larva of a lepidopteron;
- 10) *L. adersi* sp. nov., on mango leaves at Zanzibar;
- 11) *L. africanum* Newstead, seriously attacking the leaves of coffee tree at Chagwe (Uganda);
- 12) *L. cajani*, sp. nov., on *Cajanus indicus* in South Nigeria; this coccid is attacked by chalcids;
- 13) *L. hesperidum* Linn. on *Phoenix dactylifera* at Bournemouth and Chester (England);
- 14) *L. (Saissetia) hurae* sp. nov., on *Hura crepitans* at Belmopan (British Guiana);
- 15) *L. (Saissetia) persimile* sp. nov., on trunks of peach trees at Nairobi;
- 16) *L. (Saissetia) subhemisphaericum* sp. nov., on coffee tree at Ntungwe, Chagwe (Uganda) and at Aburi (Gold Coast);
- 17) *Saissetia signalum* on guava tree at Entebbe (Uganda);
- 18) *Saissetia scutatum* sp. nov., on "cannon ball tree" (*Mimosa globosa*) in the Botanical Garden at Georgetown; the small female colonies of this scale-insect were attacked by a small black ant;
- 19) *L. (Saissetia) subpatelliforme* sp. nov., on an undetermined plant at Aburi;
- 20) *L. (Saissetia) subhirsutum* sp. nov., on *Blighia sapida* at Odumase (Gold Coast); the individuals of this species were very numerous on the smallest branches; the coccid is attacked by small red ants; the same species has also been collected from *Tabernaemontana*, *Landolphia*, *Oroxylon* and *Garcinia* at Aburi;
- 21) *L. setigerum* sp. nov., on guava at Nagunga (Uganda);
- 22) *L. (Eucalymnatus) chelonoides* sp. nov., on *Pachira insignis* in the Botanical Garden at Georgetown and on *P. aquatica* on the Essequibo river, near Agatask in British Guiana;
- 23) *Aspidiotus camelliae* Sign., on *Erythraspis glauca* at Turke (British Guiana);
- 24) *A. (Chrysomphalus) dictyospermi* Morgan, on rose bush at Entebbe

branches examined were severely attacked by the scale insect ; about per cent. of the colony had been destroyed by a fungus ;

25) *A. (Chrysomphalus) erythraspidis* sp. nov., on *Erythr. glauca* at Keyn ;

26) *A. (Evaspidiolus) fimbriatus* Mask. var. *capensis* var. nov., on radaceae at Port Elizabeth (Union of South Africa) ;

27) *A. (Chrysomphalus) mauritianus* sp. nov., on palms in the Botanical Garden at Mauritius ;

28) *A. pimentae* sp. nov., on *Pimenta officinalis* in Jamaica; the damage caused by this species resulted on one estate — Great Valley, in the Parish Hanover — in the loss of over 2000 trees ; the trunks were covered by insect which spread in this plantation in the direction of the prevailing winds ; healthy trees are not attacked, but those which are the host of insect begin slowly to perish, the extremities of the branches showing first signs of disease ; *A. pimentae* has a natural enemy in the fungus, *Tricogramma Duriaci* ;

29) *Chionaspis distorta* sp. ; nov., on an undetermined tree at Winshoom, Transvaal (Union of South Africa) ;

30) *Ch. capensis* sp., nov., on *Acacia* sp. at Pretoria (Union of South Africa) ;

31) *Ch. fici*, sp. nov., on wild fig tree at Kabete.

Diseases and Pests of Cultivated Plants in the Dutch Indies during 1916. — VAN HALL, C. J. J., in *Mededeelingen van het Laboratorium voor Plantenziekten*, No. 29. Batavia, 1917.

This publication — compiled by the direction of the Phytopathological Laboratory — summarises the data supplied by the Experiment Stations and by the officials of the Information Bureau of the Department of Agriculture, Industry and Commerce and other information received by the said Laboratory during 1916.

In 1916 crops suffered little from animal pests ; probably the summer monsoon of 1915, which was relatively rainy, had a favourable influence. On the other hand, the greater rainfall favoured diseases due to fungi.

In plantations belonging to Europeans, locusts (*Cyrtacanthacris nigripennis*) did little damage, excepting on a few plantations of Hevea.

Phytophthora Faberi, as usual, ravaged various plantations of rubber not only in the rainy season but also in the months October-December of the dry season, which this year was exceptionally rainy. The plantations situated in the low wet parts of the island suffered most from this disease. The heavy rains caused an abnormal fall of leaves of Hevea.

In the west of Java, *Xyleborus coffeae* attacked *Coffea robusta*.

In 1916, *Cryphalus hampei* appeared for the first time in the west of the island, where it occurred on a large scale in plantations of *Coffea liberica* and *C. robusta*.

Rats were troublesome in places to coconut plantations in the residency Besoeki.

As in 1915, *Helopeltis* attacked many plantations of cacao.

A few tobacco plantations were damaged by storms at Deli ; but in

regard to diseases and pests the year 1916 was a favourable one for the crop.

The heavy rains in the residency of Java caused a partial loss to tobacco plantations through root rot and also through *Phytophthora Nicotianae*.

The chinchona plantations suffered more than usual from "djambu oepas" (*Corticium* sp.).

Generally speaking, the year 1916 was fairly favourable to tea cultivation (*Thea assamica*, etc.), although *Heliopeltis* and *Cephaleuros virescens* had attacked the plantations badly in places.

Sugarcane suffered from a disease similar to "sereh" which especially damaged the variety 100 P. O. J. Varieties with high sugar yield but with a poorly developed root-system suffered mostly from diseases of the roots.

The mahogany plantations (*Swietenia Mahagoni*) of the forest Service were attacked by a species of *Hypsipyla* which threatens to be fatal to the cultivation of this tree.

The crops of "sono-king" (*Dalbergia latifolia*) were attacked by disease the nature of which is uncertain.

The following diseases of native crops were brought to the notice of the laboratory. With the exception of a few regions the damage done to rice by insects (*Schoenobius* and *Scirpophaga*) was of small importance. While at Sumatra the rice was attacked by rats, at Java the rice-fields were immune.

A *Cecidomyia* appeared in some Javan residencies, *Leptocorisia* ("walang sangit"), in the residency of Bantam; and at Sumatra some rice fields were ravaged by *Podops*.

As usual, maize was attacked by the disease "omo lye" due to *Rhizoctonia Maydis*.

1916 was an extraordinary year for ground-nuts.

The soy-bean crops suffered in a part of the Paseroean residency from a disease of bacterial origin. *Agromyza* did great injury.

Potato-growing is being extended more and more but is subject to various diseases due to *Alternaria Solani*, *Bacillus Solanacearum*, *Achaetomyces Scabies*, etc.

Coconut trees suffered more than usual from *Pestalotzia*, which attacked the leaves. Probably the rains favoured the development of this fungus. In the Ternate residency and on some islands round about, the trees were attacked by *Cyrtacanthacris nigricornis*.

979 - Fruit Flies (Sub-Genera *Tridacus* and *Dacus*), observed in Erythraea, Nyassaland and Mauritius. — BRIZZI, M., in *Bulletin of Entomological Research*, Vol. VI, Part 1, pp. 63-71, fig. 1-6. London, 1917.

In order to complete his previous paper (1), the writer published the present systematic description of the following species of fruit-flies.

- 1) *Tridacus d'emmerezi*, sp. nov., found in Mauritius in 1916.
- 2) *Dacus annulatus*, Becker; this species was collected in Eg

(1) See also, B. Nov. 1915, No. 1226.

it a century ago; it was recorded from Erytraea in 1911, and was recovered in Dec. 1916 in Ghinda, Erytraea, where it was very common.

- 3) *D. mockii* sp. nov., also taken near Ghinda in December 1916.
- 4) *D. woodi*, sp. nov., collected in Nyasaland, on September 22, 1916.
- 5) *D. hamatus*, sp. nov., also from Nyasaland (May 11, 1916).
- 6) *D. blepharogaster* sp. nov., taken near Ghinda (November 7, 1916).
- 7) *D. erythraeus* sp. nov., also from Ghinda (December 3, 1916).

***Crotalaria usaramoensis*, a Plant for Green-Manuring. Resistant to Insect Attacks, in Java.** — See No. 903 of this Review.

RESISTANT
PLANTS

The Natural Enemies of the Macrolepidopteron *Oiceticus platensis* ("bicho canasto") Attacking Trees in the Argentine (1). — CARIDE, MASSIMI PEDRO, in *Anales de la Sociedad Rural Argentina*, Year LII, Vol. LI, No. 5, pp. 373-378, figs. 1-8, Buenos Aires, 1917.

MEANS
OF PREVENTION
AND CONTROL

In 1916 the author undertook a study of the natural enemies of *Oiceticus platensis* Berg, a pest of trees in the Argentine, and whose ravages have been reported from the province of Buenos-Aires, Pampa-Central, Cereños, the south of Córdoba and Santa Fé.

Although this insect is very widespread in the south of Córdoba and the province of Buenos-Aires, it is present in such small numbers north of the north of Córdoba and Santa Fé, that it is difficult to verify damage caused by it; this is equally true in Tucuman, Salta and Tucujuy. This is due to the fact that, in these districts, *Oic. platensis* is attacked in spring, while it is still in the larval stage, by natural enemies (*Eurytoma caridei* Br. n. sp., *Microctonus argentinae* Brad., *P. argentinae* Brad. var. *caridei* Bréthes n. sp., *Lindesonium caridei* Br. n. sp.). These enemies are more efficacious than those which attack the insect in winter when it has already reached the adult stage (e. g., *Tetrastichus platensis* Bréthes).

In order to assure the acclimatisation, in the most seriously infested districts of the most efficacious of the natural enemies of the insect it is necessary: 1) to collect in December a large number of young *Oiceticus* in the province of Buenos Aires; 2) to transport them to the north of Córdoba, distribute them, so that observation is facilitated, on low trees (robby preference), where they will be attacked by their natural enemies; 3) to collect, a month, or a month and a half after, the same insects, now adults, of their natural enemy, and re-transport them into the district infested with *Oic. platensis*.

***Euzophera ossentella*, a Macrolepidopteron Attacking Potatoes, in Egypt.**

— CASORIA, M., in *Bulletin de l'Union des Agriculteurs d'Egypte*, Year 15, No. 120, pp. 77-81, Cairo, 1917.

INSECTS, ETC.
INJURIOUS
TO VARIOUS
CROPS

At the end of April, 1916, a potato field ("Farineuse rouge" or "Boule farine", "Early rose" and "Kidney" varieties) on a small estate at Amoun (Hehya-Charkieh) was strongly attacked by larvae of mole-crabs, and a coleopteron closely resembling the cockchafer. The soil received copious supplies of manure, of calcium phosphate and of po-

tassium sulphate. At the time they were attacked the plants had reached about a third of their full growth.

It was necessary to harvest the tubers and to remove the larvae immediately. It was remarkable that a small plot which had been treated with the insecticide "War-worms" and manganese carbonate, was completely free from larvae.

In 1917 it was only possible to plant Cyprus potatoes which, according to the author, are degenerated or hybrid kidneys. The ground was treated with manganese carbonate, to which had been added magnesia, sulphur, ferric oxide, and a small quantity of "War worms".

At the end of April many plants were seen to be drooping; a week later these plants were almost completely dried up, as if they had been cut level with the earth, while many other plants began to fade, either in the same field, or in another about 215 yards distant.

An examination of the soil showed the presence of numerous larvae, a microlepidopteron, identified by the Director of the Entomological Bureau of the Department of Agriculture as *Euzophera ossatella* (fam. *Pyralidae*). This insect, which had been previously reported in Egypt, perforates the stalks of aubergine, and is also found on potatoes.

According to the author the larvae climb about 2 to 3 cm. up the stem and feed on the pith. A few days later, when the plant attacked begins to fade, the larva leaves it for another, and so on, till it turns into a chrysalis when it weaves its silky cocoon on the stalk itself. As many as five cocoons have been noticed on one stalk. Fifteen or twenty days after the first metamorphosis the insect becomes adult in the form of a tobacco-butterfly, 1.5 cm. long.

Besides the drooping and drying-up of the epigeal part of the plant, the insect stops the growth of the tubers, which send out shoots. Tubers thus attacked are useless, both as food and as seed-potatoes, because, if left in the ground, there is no doubt that the ensuing crop will be weak and attacked by the larvae of the insect.

The best method of fighting this pest is to pull up the plants attacked and burn them.

983 - *Tarsonemus pallidus*, a Mite Parasitic on Cyclamen and Other Plants in the United States (1) -- MOZNETTE, G. F., in *Journal of Agricultural Research*, Vol. 8, pp. 373-390, fig. 1-6, plates 31-52, Washington, D. C., 1917.

Tarsonemus pallidus Banks. (the cyclamen mite), is widely known in the United States, where it causes nearly every year more or less serious damage to cyclamen plants. It also attacks Chrysanthemums and has been reported on the snapdragon (*Antirrhinum* spp.) in Connecticut and Maryland.

The spread of the cyclamen mite is no doubt due to the transport of plants from one place to another.

The writer observed this mite for the first time at the beginning

(1) See also R. June 1917, No. 616.

autumn of 1916 at Corvallis, Oreg., and has since had the opportunity examining specimens of *T. pallidus* from different parts of the United States.

After describing the injury caused by the parasite to the leaves and roots of the cyclamen, the writer gives an account of the different stages of development, followed by data relating to its life history and the best methods of controlling the pest.

***Physothrips xanthius* sp. nov., a New Thysanopteron Damaging Cultivated Orchids (*Cattleya*) in Trinidad, West Indies** — WILLIAMS, C. E., in *Bulletin of Entomological Research*, Vol. VIII, Part 1, pp. 59-61, 1 fig. London, 1917.

The writer describes, as a species new to science, *Physothrips xanthius* n. sp. (Thripidae), which was found on cultivated *Cattleya* orchids in Port of Spain, Trinidad, during 1915 and 1916.

The larvae and pupae are found with the adults on the upper surfaces of the leaves, particularly near the mid-rib and towards the base of the leaf. They cause severe injury by piercing the surface, resulting in brownish spots or patches on the leaves. In severe cases, the plant may be entirely killed.

Up to the present, this thysanopteron has not been found on wild orchids, and it is possible that it is not indigenous to Trinidad. A large number of orchids are brought over from Venezuela, and the new parasite may have been imported with them.

Phytopathological Notes on Hevea. — KENCHESTES P. B., in *Meldedelingen van het Konink. Instituut*, No. 24, pp. 49-54. Soerabaja, 1917.

1) SCOLYTIDAE. — On a plantation where the tapping-surfaces had been kept clean, the Hevea trees were affected by Scolytids to such a degree, that latex was flowing from the small holes bored. The bark, however, remained unaffected above the cleaned tapping-surface. It was impossible to take a boring insect for identification. This indicated that it is desirable to scrape away too thick a cork-layer from the tapping-surface. This not only encourages attacks by borers but also causes the formation of a thick layer of corky bark, making subsequent tapping difficult.

2) BORING BEETLES. — The beetle *Dihammus fistulator* Germ., already known as a *Ficus*-borer, also attacks the stem of Hevea, especially on injured spots. Healthy trees are only occasionally attacked. The larvae of borers should be cut out or killed with benzine.

3) LATEX-DRINKING BEETLES. — The beetle *Xylocratus gideon* L. is sometimes found drinking the latex from the tapping-cut. It, however, never becomes a serious pest.

4) ATMOSPHERIC-ELECTRICITY. — In addition to ordinary lightning, so-called St-Elmos-fire also occurs occasionally. Ordinary lightning strikes a close group of trees acting as conductors, while the branches of the surrounding trees in the direction of the central conductors get scorched. The results of St-Elmo's-fire are entirely different. In this instance there was no definite close group of damaged Hevea-trees but about ten attacked trees, with some other Heveas amongst them which were entirely unharmed. Three Heveas were dead, but the others had only a burnt topshoot

and normal sidebranches. A similar phenomenon has been described in TUBEUF as "Gipfeldürre", while experiments have proved its possibility.

5) *Cyrtacanthacris nigricornis*. — In consequence of the fact that in the year 175 bouws of Hevea on an estate in Besoeki (East-Java) were seriously affected by *Cyrtacanthacris nigricornis* Burm., some observations have been made concerning the development of this insect.

The eggs are laid in the ground in packages. The incubation period is from 5 to 9 months. The newly born larvae have a size of 7 mm. and pass through six moults. The first moult occurs after 7 to 8 days, the other with intervals of about 12 days. The shortest time between two moults is 7, the longest 16 days. The development period until the last moult is from 2 to 2 ½ months. One month after the last moult, copulation takes place and then after a fortnight the first eggs are ejected by the female. They may lay eggs 7 times with intervals of about 12 days.

The full-grown insects may live 4 to 4 ½ months making a total time of nearly 7 months from the larval stage. The total development of this insect takes about 9 ½ to 13 ½ months and even longer.

Considering that the insect is continually feeding during this time one can imagine what destruction several million of these insects may bring about.

986 - "Elm-galerucella" (*Galeruca luteola*) in Spain in 1917 (1). — DANTON CEDA, J., in *La Liza Agraria*, Year XXX, No. 1139, p. 2, Madrid, 1917.

Galeruca luteola F. Müller, a small chrysomelid beetle known for long time in Spain, never caused so much damage to the foliage of elms as in 1917. It seems as if the continual drought — there was no rain from the beginning of June — and the sub-tropical heat, especially of the last twenty days of July, were particularly favourable to the growth of the insect.

During the months of May and June, when the larvae had already appeared, the damage was not very marked, but, in July, as the drought and heat increased, the larvae multiplied and became more voracious. The leaves began to fall during the first ten days of August, and, soon after, the trees were completely bare.

Data on the biology of the coleopteron and the methods of control are given.

987 - *Leucaspis pini*, a Coccid Attacking Pines, in the Argentine. — FREZZO, J. in *Anales de la Sociedad Rural Argentina*, Year LII, Vol. LI, No. 5, p. 351, Buenos Aires, 1917.

In July, 1917, the Biological Institute of the Argentine Rural Society received, from the Province of Buenos-Aires, a pine branch attacked by a scale insect, identified by the author as *Leucaspis pini* (Hartig), commonly known as "pioyo del pino".

This insect, peculiar to the pine, has long been known in Euro-

(1) See also R. May 1916, No. 593.

and, more recently, in North America. This is the second occasion on which it has been found in the Argentine, the first one being in 1906, on material sent from Mendoza.

Up to the present nothing definite is known of the natural enemies of this insect.

Of the different insecticides proposed, those with a petroleum basis seem to give the best results. The following mixture is recommended: petroleum, 1 000 gr. ; soft soap, 400 gr. ; water, 1 500 gr.